

INSECTS OF HAWAII

A Manual of the Insects of the Hawaiian Islands, including an Enumeration of the Species and Notes on their Origin, Distribution, Hosts, Parasites, etc.

VOLUME 14
DIPTERA: CYCLORRHAPHA IV,
SERIES SCHIZOPHORA
SECTION CALYPTRATAE

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PREFACE TO VOLUME 14

This volume deals with the suborder Cyclorrhapha, division Schizophora, section Calyptratae. These are the higher Diptera, muscoid flies, or the house fly family (Muscidae) and related families. Two hundred and nine described species and one subspecies, plus seven undescribed new species, in eight families of calyptrate flies are treated. These are arranged in three superfamilies, following Hennig (1973). One hundred and thirty-three species are considered endemic to the Hawaiian Islands. These fit predominantly in two genera of two families: *Lispocephala* (Muscidae) with 105 presently known species and *Dyscritomyia* (Calliphoridae) with 24 species. Also three species of the muscid genus *Lispe* and one species of *Ornithoctona* (Hippoboscidae) apparently are endemic.

Of the immigrant species, most of the Tachinidae have been purposely introduced for biological control; the others are accidental introductions. It is evident that some of the domestic flies may have been brought in by the early Hawaiians (Hardy 1960a:17).

The flies in the division Schizophora are characterized by the presence of the frontal (ptilinal) suture in the adults and by the wing venation, which is rather uniform throughout the group. The Calyptratae are differentiated by the presence of a prominent longitudinal cleft or seam on the outside surface of the second antennal segment; mesonotum with a distinct, more or less continuous transverse suture (figs. 83 and 126) and with prominent posterior calli. Roback (1951:333) characterized the larvae of Calyptratae as having the "pharyngeal sclerite well developed, generally well pigmented and robust; hypostomal sclerite short and robust; oral hooks separated or appressed; posterior spiracles plate-like, ovoid or reniform, with variable openings."

This volume completes the background work on the Diptera which I began over 25 years ago. When the studies began, approximately 329 species had been recorded from the Hawaiian Islands; at least two dozen of these were incorrectly recorded from the islands or are synonyms, and many of the names were based upon misidentifications. We now recognize approximately 1,450 species belonging in 47 families; about half of the species are endemic. It is obvious that the total Diptera fauna will number at least 1,700 species; there are still considerable numbers of new species of Drosophilidae, Dolichopodidae, Muscidae (*Lispocephala*), etc., remaining to be described.

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Canada Department of Agriculture, Ottawa. The section on the endemic Calliphorids, *Dyscritomyia*, was prepared by M. T. James, Washington State University, Pullman. I am very appreciative of this valuable help. Special thanks go to Mercedes Delfinado, New York State Museum, Albany, for help in doing the preliminary sorting of *Lispocephala* and for help with the field work, and to Steven Montgomery, graduate student, University of Hawaii, for all the help he has given in collecting materials, and obtaining host information and biological data on many of the endemic species. Thanks are also due K. Y. Kaneshiro and others of the project on evolution of Hawaiian Drosophilidae for collecting many *Lispocephala* associated with *Drosophila* habitats.

The art work was done over a period of many years by the following, who were then, or are now, students at the University of Hawaii: Laura Casey, Roanne Tsutsui, Camile Wong, Martha Turnbull, Aileen Matsuyama, Robert Suzuki, Gay Yoshikawa, Glen Y. Shiraki and Jack W. Grubb. The excellence of these illustrations adds greatly to the value of this work.

The typing was done by Mrs. Deanna Espinas. Her meticulous work simplified my task considerably.

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CHECKLIST OF THE INSECTS IN THIS VOLUME

Order DIPTERA

Superfamily HIPPOBOSCOIDEA

Family HIPPOBOSCIDAE

Subfamily ORNITHOMYINAE

Tribe ORNITHOMYINI

Genus **Ornithoica** Rondani
vicina (Walker)

Genus **Ornithoicta** Speiser
hulahula Maa

Tribe OLFERSIINI

Genus **Icosta** Speiser

Subgenus **Ornithoponus** Aldrich
nigra (Perty)

Genus **Olfersia** Leach
aenescens Thomson

spinifera (Leach)

Genus **Pseudolychia** Bequaert
canariensis (Macquart)

Subfamily LIPOPTENINAE

Genus **Melophagus** Latreille
ovinus (Linnaeus)

Superfamily MUSCOIDEA

Family ANTHOMYIIDAE

Subfamily FUCCELLINAE

Genus **Fucella** Robineau-Desvoidy
boninensis Snyder

Subfamily ANTHOMYIINAE

Genus **Anthomyia** Meigen
illocata Walker

Genus **Hylemya** Robineau-Desvoidy
Subgenus **Delia** Robineau-Desvoidy
platura (Meigen)

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
Genus Ornithoica Rondani vicina (Walker)	x				x	x	Widespread over New World
Genus Ornithoicta Speiser hulahula Maa	x		x				
Genus Icosta Speiser Subgenus Ornithoponus Aldrich nigra (Perty)	x			x			Nearctic and Neotropical regions
Genus Olfersia Leach aenescens Thomson					x		Northwestern Hawaiian Is.: Laysan, French Frigate Shoal, Lisiansky; and Pantropical over Pacific, Atlantic, and Indian oceans
spinifera (Leach)							Northwestern Hawaiian Is.; Pantropical over Pacific, Atlantic, and Indian oceans
Genus Pseudolychia Bequaert canariensis (Macquart)	x	x	x	x	x	x	Cosmopolitan
Genus Melophagus Latreille ovinus (Linnaeus)	x				x		Kahoolawe; Nearctic, Neotropical, and Palearctic regions
Genus Fucella Robineau-Desvoidy boninensis Snyder							Probably spread over North- western Hawaiian Is.
Genus Anthomyia Meigen illocata Walker	x	x	x	x	x	x	Widespread over Oriental Region, East Asia, Micronesia, and Papuan subregion
Genus Hylemya Robineau-Desvoidy Subgenus Delia Robineau-Desvoidy platura (Meigen)	x	x	x	x	x	x	Cosmopolitan

CHECKLIST

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	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
Tribe PHAONIINI							
Genus Gymnodia Robineau-Desvoidy							
arcuata Stein	x	x	x	x	x	x	N. America to Ontario, Canada
Subfamily MYDAEINAE							
Genus Graphomya Robineau-Desvoidy							
occidentalis Arntfield	x	x			x		California to Mexico
Subfamily LIMNOPHORINAE							
Genus Lispe Latreille							
argenteifacies Grimshaw		x	x	x		x	
metatarsalis Thomson	x	x	x	x	x	x	
pectinipes Becker					x		
ponti Hardy, n. sp.	x				x		Southern Europe and N. Africa
Subfamily COENOSIINAE							
Genus Lispocephala Pokorný							
Group Alakaiae							
Subgroup Alakaiae							
alakaiae Hardy, n. sp.						x	
aquila Hardy, n. sp.		x					
aspilota Hardy, n. sp.		x					
crassifemur Malloch					x		
deceptiva Hardy, n. sp.		x					
dentata Hardy, n. sp.		x					
fusca Malloch					x		
fusciseta Malloch					x		
fuscifacies Malloch					x		
inconstans Malloch					x		
incompta Hardy, n. sp.						x	
intonsa Hardy, n. sp.		x					
n. sp.(?) intonsa -like	x						
leptostylata Hardy, n. sp.						x	
parydra Hardy, n. sp.			x				
pectinata Hardy, n. sp.	x						
penaquila Hardy, n. sp.		x					
perflava Hardy, n. sp.			x				
philydra Hardy, n. sp.	x						
rudis (Grimshaw)		x					
silvicola Hardy, n. sp.		x					
striata (Grimshaw)					x		
swezeyi Hardy, n. sp.	x						
tridentata Hardy, n. sp.			x				
whittlei Hardy, n. sp.		x					
Subgroup Confluens							
brunneipennis Hardy, n. sp.	x						
carita Hardy, n. sp.		x					
confluens Malloch		x					Probably Hawaii
expulsa Hardy, n. sp.					x		
flavobasalis (Grimshaw)	x						Possibly all other Hawaiian islands
flavobasalis <i>extera</i> Hardy, n. subsp.		x	x				
flexa Hardy, n. sp.						x	
fuscobrunnea Malloch	x						Possibly Maui
implumis Hardy, n. sp.					x		
indecisa Hardy, n. sp.	x?	x	x	x			
kauaiensis (Grimshaw)						x	

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
<i>montgomeryi</i> Hardy, n. sp.						x	
<i>obscura</i> Hardy, n. sp.	x						
<i>paloloae</i> (Malloch)		x	x				Possibly Kauai
<i>parilis</i> Hardy, n. sp.		x	x				
<i>pauciseta</i> Hardy, n. sp.					x		
<i>rufibasis</i> Malloch			x				
<i>subvittata</i> Malloch	x						
<i>triangulifera</i> (Grimshaw)	x						
<i>xanthopleura</i> Hardy, n. sp.		x					
Group Brevispina							
Subgroup Brevispina							
<i>badia</i> Hardy, n. sp.		x					
<i>brevispina</i> Malloch					x		
<i>brunnidorsata</i> Hardy, n. sp.		x					
<i>caliginosa</i> Hardy, n. sp.		x					
<i>dispar</i> (Grimshaw)			x				
<i>haleakalae</i> Hardy, n. sp.		x					
<i>hualalaiae</i> Hardy, n. sp.	x						
<i>longisetosa</i> Hardy, n. sp.		x	x				
<i>mauiensis</i> Hardy, n. sp.		x					
<i>mimetica</i> Hardy, n. sp.		x	x				
<i>nana</i> Hardy, n. sp.			x				
<i>sigillata</i> Hardy, n. sp.	x						
Subgroup Atratipes							
<i>argentifrons</i> Hardy, n. sp.		x	x				
<i>ascita</i> Hardy, n. sp.		x					
<i>atratis</i> Malloch	x						
<i>brunneifrons</i> Hardy, n. sp.						x	
<i>chaetoloma</i> Hardy, n. sp.		x					
<i>comata</i> Hardy, n. sp.	x						
<i>comparata</i> Hardy, n. sp.						x	
<i>eximia</i> Hardy, n. sp.	x						
<i>kaalae</i> Williams					x		
<i>ocellata</i> Hardy, n. sp.		x	x				
<i>parva</i> Hardy, n. sp.						x	
Group Pallidibasis							
Subgroup Pallidibasis							
<i>bispina</i> Malloch					x		Molokai, Maui (?)
<i>hamifera</i> Hardy, n. sp.		x					
<i>ingens</i> (Grimshaw)	x	x	x		x		
<i>lanaiensis</i> Hardy, n. sp.				x			
<i>pallidibasis</i> Malloch					x		
n. sp. <i>pallidibasis</i> -like (?)	x						
<i>planifemorata</i> Hardy, n. sp.		x	x				
<i>zonata</i> Hardy, n. sp.			x				
Subgroup Dexioides							
<i>biseta</i> (Grimshaw)	x						
<i>brachydexioides</i> Hardy, n. sp.	x						
<i>dexioides</i> (Grimshaw)	x						
<i>difficilis</i> Hardy, n. sp.					x		
<i>dilatata</i> Malloch	x						
<i>flaccida</i> Hardy, n. sp.		x					
<i>hirtifemur</i> Malloch						x	
<i>latimana</i> (Grimshaw)				x			

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
latitarsis Hardy, n. sp.					x		
longipes (Grimshaw)	x	x	x	x			
pollinosa Malloch		x					
seminitida Malloch					x		
univittata Hardy, n. sp.	x						
valida (Grimshaw)		x					
villosifemora Hardy, n. sp.	x						
Subgroup Seminigra							
melanoxenina Hardy, n. sp.		x					
oahuae Malloch					x		
seminigra (Grimshaw)	x						
n. sp.? 'A' female seminigra complex		x					
n. sp.? 'B' female seminigra complex	x						
subseminigra Hardy, n. sp.		x					
xenina Malloch	x						
n. sp. 'A'? xenina complex		x					
Group Fasciculata							
fasciculata Malloch	x						
macrocera Hardy, n. sp.		x					
pallida Malloch					x		
quasipallida Hardy, n. sp.						x	
subtilis Hardy, n. sp.	x						
uniseta Hardy, n. sp.	x						
waialealeae Hardy, n. sp.						x	
Subfamily STOMOXYINAE							
Genus Haematobia Lepeletier and Serville							
irritans (Linnaeus)	x	x	x	x	x	x	Europe, N. America (including Canada), and W. Indies
Genus Stomoxys (Geoffroy)							
calcitrans (Linnaeus)	x	x	x	x	x	x	Cosmopolitan
Family CALLIPHORIDAE							
Subfamily CALLIPHORINAE							
Tribe CALLIPHORINI							
Genus Aldrichina Townsend							
grahami (Aldrich)					x		Widespread over western U.S., China (Szechuan Province), Siberia, Japan, Korea, Taiwan, Pakistan, and India
Genus Calliphora Robineau-Desvoidy							
vicina Robineau-Desvoidy					x		Nearctic, Neotropical, and Holarctic regions; southern Africa, and southern Australia
vomitorea (Linnaeus)	x	x	x	x	x	x	Palearctic, Oriental, and Nearctic regions, and S. Africa
Genus Eucalliphora Townsend							
lilaea (Walker)	x	x	x	x	x	x	Western N. America—Alaska to Ontario, south to northern Mexico and Colorado
Genus Melinda Robineau-Desvoidy							
pusilla (Villeneuve)					x		Burma, China, Japan, and Taiwan

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
Tribe LUCILIINI							
Genus Dyscritomyia Grimshaw							
affinis Grimshaw					x	x	
alta Hardy, n. sp.		x					
bryani James, n. sp.		x	x				
caudata James, n. sp.	x						
claripennis Grimshaw	x						
cuprea James, n. sp.					x		
digitata James, n. sp.		x					
divisa James, n. sp.					x		
fasciata (Grimshaw)	x	x	x	x	x	x	
fulgens Grimshaw				x	?	?	
grimshawi James, n. sp.	x	x					
hawaiiensis Grimshaw	x	x		x			
lata James, n. sp.	x						
limbipennis (Thomson)					x	x	Molokai (?)
luciliodes (Grimshaw)	x						
nigerrima James, n. sp.						x	
obscura (Grimshaw)	x						
pectinata James, n. sp.	x						
retracta James, n. sp.						x	
robusta (Grimshaw)		x	x	x			
scopifera James, n. sp.			x				
similis James, n. sp.	x						
sternacantha James, n. sp.	x						
terryi Bryan					x		
viridis Hardy, n. sp.	x						
Genus Lucilia Robineau-Desvoidy							
graphita Shannon							Northwestern Hawaiian Islands: Laysan, Ocean, Kure, and Midway Is., and Pearl and Hermes Reef
Genus Phaenicia Robineau-Desvoidy							
cuprina (Wiedemann)	x	x	x	x	x	x	Widely distributed throughout both hemispheres in the tropics, subtropics, and warmer temperate regions
sericata (Meigen)	x	x	x	x	x	x	Cosmopolitan
Subfamily CHRYSOMYINAE							
Tribe CHRYSOMYINI							
Genus Chrysomya Robineau-Desvoidy							
megacephala (Fabricius)	x	x	x	x	x	x	Widespread over Oriental, Australian, and Pacific regions; also Japan, Ryukyu Is., China, Egypt, and southern Palaearctic Region
rufifacies (Macquart)	x	x	x	x	x	x	Widely distributed over Oriental and Australian regions, Japan, and Pacific area
Tribe PHORMIINI							
Genus Phormia Robineau-Desvoidy							
regina (Meigen)	x	x			x	x	Probably on other Hawaiian islands; Holarctic Region; over entire U.S. to Mexico and Hawaii

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
Subfamily POLLENIINAE							
Tribe POLLENIINI							
Genus Pollenia Robineau-Desvoidy rudis (Fabricius)	x				x	x	Nearctic and Palearctic regions, N. Africa
Subfamily RHINIINAE							
Genus Rhinia Robineau-Desvoidy apicalis (Wiedemann)	x	x	x	x	x	x	Widespread throughout Africa, Asia Minor, southeastern Asia, Solomon Is., Fiji, Philippine Is., Micronesia, and Hawaii
Family SARCOPHAGIDAE							
Subfamily MILTOGRAMMINAE							
Genus Amobia Robineau-Desvoidy pelopei (Rondani)					x		Widespread over Oriental Region, S. Pacific, Australia, southern Africa, southern Europe, and Turkestan
Subfamily AGRIINAE							
Genus Goniophyto Townsend bryani Lopes							Northwestern Hawaiian Is.: French Frigate Shoals, Necker Is., Pearl and Hermes Reef, Kure Is., Midway, and Johnston Is.
Subfamily SARCOPHAGINAE							
Tribe RAVINIINI							
Genus Chaetoravinia Townsend anandra (Dodge)		x	x				Widespread over U.S.
Genus Ravinia Robineau-Desvoidy Subgenus Ravinia Robineau-Desvoidy iherminieri (Robineau-Desvoidy)	x	x	x	x	x	x	North America
Tribe SARCOPHAGINI							
Genus Bercaea Robineau-Desvoidy haemorrhoidalis (Fallén)	x		x	x	x	x	Probably on all main Hawaiian islands; nearly cosmopolitan
Genus Boettcherisca Rohdendorf peregrina (Robineau-Desvoidy)	x	x	x	x	x	x	Spread widely over the Oriental Region, much of the Pacific including Bonin, Volcano, and southern Mariana Is., Samoa, New Guinea, Australia, Japan, South China
Genus Helicobia Coquillett morionella (Aldrich)	x	x	x	x	x	x	Southern portion of U.S., California to N. Carolina, Mexico and West Indies, also on Wake I.
Genus Hystericocnema Townsend plinthopyga (Wiedemann)	x	x	x	x	x	x	Western and southern U.S., Mexico, West Indies, and Virgin Is.

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
Genus Parasarcophaga Johnson and Tiegs Subgenus Parasarcophaga albiceps (Meigen)		x			x		Widespread over Oriental and Palaearctic regions, New Guinea, New Britain, and Solomon Is.; probably on other islands
Subgenus Liopygia Enderlein ruficornis (Fabricius)					x	x	Spread over the Oriental Region, including the Ryukyu and Amami islands, south of Japan, Mariana Is., Moluccas, Samoa, Africa, and Madagascar
Subgenus Liosarcophaga Enderlein misera (Walker)	x	x	x	x	x	x	Widespread over the Oriental Region and throughout much of the Pacific to Australia
Subgenus Thomsonea Rohdendorf argyrostoma (Robineau-Desvoidy)	x	x	x	x	x	x	Cosmopolitan
Genus Phytosarcophaga Rohdendorf gressitti (Hall and Bohart)					x	x	Micronesia, Philippines, and Ogasawara Is.
Genus Seniorwhitea Rohdendorf krameri (Boettcher)					x	x	Probably spread over all the islands including Northwestern Hawaiian Is.; widespread over Oriental Region; also Foochow, China
Tribe SARCOPHAGULINI							
Genus Sarcophagula van der Wulp occidua (Fabricius)	x	x	x	x	x	x	Neotropical; southern U.S., Texas to Florida; on other islands in the eastern Pacific (not including Micronesia)
Tribe TEPHROMYIINI							
Genus Blaesoxipha Loew Subgenus Blaesoxipha Loew filipjevi Rohdendorf lineata (Fallén)					x*	x	Palaearctic and Ethiopian regions Palaearctic and Ethiopian regions
Family TACHINIDAE							
Subfamily PHASIINAE							
Tribe LEUCOSTOMATINI							
Genus Leucostoma Meigen aterrimum (Villers)	x				x	x	Probably widespread through all main islands; Palaearctic and Nearctic regions

*Not known to be established.

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
simplex (Fallén)	x				x	x	Probably on all main islands; Palaearctic and Nearctic regions
Tribe TRICHOPODINI							
Genus Trichopoda Berthold							
Subgenus Galactomyia Townsend							
pennipes (Fabricius)		x*					Eastern U.S., Kansas to Connecticut, south to Florida and into Mexico
pilipes (Fabricius)	x	x	x	x	x	x	Antigua, West Indies
Subfamily TACHININAE							
Tribe DEJEANIINI							
Genus Archytas Jaennicke							
cirphis Curran	x	x	x	x	x	x	Mexico
Subfamily GONIINAE							
Tribe ANACAMPTOMYIINI							
Genus Euvespivora Baranov							
decipiens (Walker)					x		Moluccas, New Britain, Solomon Is.
Tribe BLONDELIINI							
Genus Eucelatoria Townsend							
armigera (Coquillett)	x	x	x	x	x	x	California to Texas, also West Indies
n. sp.? "Arizona"*	x	x	x		x	x	Arizona
n. sp.? "Mexico"*	x	x			x	x	Mexico
Genus Lixophaga Townsend							
beardsleyi Hardy, n. sp.					x*		New Guinea, Wau, Garaina
sphenophori (Villeneuve)	x	x	x		x	x	New Guinea, introduced to Australia and Fiji
Tribe ERYCIINI							
Genus Lespesia Robineau-Desvoidy							
archippivora (Riley)	x	x	x	x	x	x	Northwestern Hawaiian Is., Nearctic Region, and Mexico
Tribe EXORISTINI							
Genus Exorista (Meigen)							
Subgenus Podotachina Brauer and Bergenstamm							
sorbillans (Wiedemann)					x*		Widespread over Oriental, S. Palaearctic, and Ethiopian regions; also Japan, New Guinea, and Australia

*Not known to be established.

	Hawaii	Maui	Molokai	Lanai	Oahu	Kauai	Other Localities
Tribe GONIINI							
Subtribe GONIINA							
Genus Gonia Meigen longipulvilli Tothill	x	x	x		x		Western Canada, North America, and Mexico
Subtribe CHAETOGAEDIINA							
Genus Chaetogaedia Brauer and Bergenstamm monticola (Bigot)	x	x	x	x	x	x	Western North America, California to Texas
Genus Pseudogonia Brauer and Bergenstamm rufifrons (Wiedemann)					x		Widespread over tropics and subtropics
Tribe SIPHONINI							
Genus Actia Robineau-Desvoidy eucosmae Bezzi	x				x		Australia and Philippines (?)
Tribe WINTHEMIINI							
Genus Winthemia Robineau-Desvoidy diversoides Baranov (?)					x*		The species described from Taiwan. The specimens introduced into Hawaii were from New Britain
Family GASTEROPHILIDAE							
Genus Gasterophilus Leach intestinalis (De Geer) nasalis (Linnaeus)	x x	x x	x x	x x	x x	x x	Cosmopolitan Cosmopolitan
Family OESTRIDAE							
Subfamily HYPODERMATINAE							
Genus Hypoderma Latreille bovis (Linnaeus)	x	x	x	x	x	x	Widespread across Europe, Canada, northern U.S. to California. Records from southern U.S. and West Indies are from imported cattle
lineatum (Villers)	x	x	x	x	x	x	Cosmopolitan
Subfamily OESTRINAE							
Genus Oestrus Linnaeus ovis Linnaeus	x	x	x	x	x	x	Cosmopolitan

*Not known to be established.

SUMMARY OF THE NEW NOMENCLATORIAL CHANGES IN THIS VOLUME

Lispe cupreigena Grimshaw, new synonym of *metatarsalis* Thomson.

Lispocephala orbitalis Malloch, new synonym of *Coenosia longipes* Grimshaw.

Lispocephala plumiseta Malloch, new synonym of *Coenosia seminigra* Grimshaw.

Prostheochaeta Grimshaw, new synonym of *Dyscritomyia* Grimshaw.

Dyscritomyia fasciata (Grimshaw), new combination for *Prostheochaeta fasciata* Grimshaw.

Dyscritomyia lucilioides (Grimshaw), new combination for *Prostheochaeta lucilioides* Grimshaw.

Dyscritomyia obscura (Grimshaw), new combination for *Prostheochaeta obscura* Grimshaw.

Dyscritomyia robusta (Grimshaw), new combination for *Prostheochaeta robusta* Grimshaw.

Superfamily HIPPOBOSCOIDEA
Family HIPPOBOSCIDAE
Louse Flies

These flies are flattened dorsoventrally, rather louse-like in appearance, with the mouthparts porrect and the legs robust, widely separated on the venter, arising on the lateral margins of the thorax. They are blood-sucking ectoparasites of birds and certain mammals, many are restricted to a narrow range of hosts and a few are important pests of domestic animals.

Head and thorax strongly sclerotized. The head is flat, usually fitting into an imagination of the prothorax and as seen in profile is more flattened anteriorly, wedge shaped or triangular. Labella very short, minute. Palpi porrect, forming a sheath around the piercing and sucking proboscis. Antennae highly modified, apparently immovable, inserted in pits or in a single frontal cavity (figs. 1c, 5a) near oral margin. The basal segments are often fused with the lunule. Wings usually present, although they are apparently used only when seeking new host animals. The anterior veins are strong, dark colored and the posterior veins weak (figs. 1b, 6b). Thorax flattened, scutellum short and broad (figs. 3d, 6a). Legs short, strong, with the tarsi shortened and the claws strong, bifid or trifid (figs. 1a, 6f). Abdomen sack-like, largely membranous with the sutures indistinct and the basal segments usually fully sclerotized (figs. 1e, 6e, 7). Cerci of male reduced and female without functional spermathecae.

For a detailed account of morphology, physiology, and natural history refer to Bequaert (1953) and for taxonomy, evolution, and a revision of American genera and species, Bequaert (1954-1957). Also for taxonomy refer to Maa (1966 and 1969).

Reproduction is by adenotrophic or pseudoplacental viviparity. The female develops only one egg at a time, the larva is nursed by milk glands through the third instar, and the mature larva (prepupa) is deposited indiscriminately on the ground, away from the host. It is commonly agreed that their closest living relatives are the Tsetse flies (*Glossina*) and they are now placed in the superfamily Glossinoidea (Hennig 1973:65). Pollock (1973) has presented excellent arguments for combining Glossinidae, Hippoboscidae, and Gasterophilidae in one superfamily (Gasterophiloidea). According to the theory put forward by Pollock (1971), "flies closely resembling the living Gasterophilidae were the ancestors of the common hippoboscid-glossinid stock."

For a comparative study of the morphology and musculature of the thorax of Hippoboscidae and Glossinidae refer to Schlein (1970), and for a comparative study of the genitalia refer to Schlein and Theodor (1971), also Pollock (1973).

The taxonomic arrangement follows that of Maa (1969 and 1975). Maa (1969:237) has arranged the Hippoboscidae into three subfamilies and gives a detailed analysis of the characters for these.

The recorded Hawaiian species fit into two subfamilies, the taxa are separated by the following key:

KEY TO HIPPOBOSCIDAE IN HAWAII

1. With well-developed wings. Ornithomyinae 2
 Wings and halteres absent. Parasites of sheep.
 Lipopteninae. **Melophagus** Latreille
 **ovinus** (Linnaeus)
2. Cubital cell and ocelli absent (figs. 5a, b). Antennae
 not confluent at bases, usually widely separated.
 Olfersiini 3
 Cubital cell and ocelli present (figs. 1b, c). Bases of
 antennae confluent or nearly so (narrowly separated) Ornithomyini. 5
3. Crossvein m present (fig. 4b). No finger-like processes on posterior lateral margins of scutellum 4
 Crossvein m lacking (fig. 6b). Scutellum straight on hind margin and with pale, finger-like processes on posterior lateral margins, each of these bears two or more thin hairs (fig. 6g)
 **Pseudolynchia** Bequaert.
4. Interocular area about evenly divided by the ptilinal suture, the lunule and interantennal area (frons) fused into one broad sclerite, the apical arms of frons are contiguous for most of their length, not widely diverging (fig. 5a) . . **Olfersia** Leach 4a
 Interocular area normal in development, the interantennal area not so developed and the apical arms of frons widely diverging (fig. 3a)
 **Costa** Speiser.
- 4a. Hind margin of postvertex strongly produced, extending well beyond level with upper orbits. The latter are narrower than the inner orbits (fig. 5a). Crossvein m oblique in position; vein $R_4 + 5$ with setae along entire length and posterior portion of wing lacking microtrichia (fig. 5b)
 **spinifera** (Leach).
 Hind margin of postvertex not so developed, extending to or scarcely beyond a level with the upper orbits, the latter are as wide as inner orbits (fig. 4a). Crossvein m transverse; vein $R_4 + 5$ bare except near apex; posterior portion of wing with

microtrichia on upper side (fig. 4b)
 **aenescens** Thomson.

5. Vertical bristles not situated on tubercles. Third segment of antenna broad, leaf-like, about three times longer than wide, extending well beyond apices of palpi and rather densely setose. Antennae arising from separate pits, separated by a narrow interantennal area; basal segments fused with lunule (fig. 2d). Tip of claw divided, claws apparently trifid (fig. 2a). Humeral callus strong, horn-like. Wing veins bare except for hairs on base of costa **Ornithoctona** Speiser.

Vertical bristles on tubercles (figs. 1c, d). Antennae situated in a single frontal cavity. Third segment rounded, about as wide as long, antennae slightly diverging and not extending to tips of palpi and with three strong bristles on outer edge of third (fig. 1c). Tip of claw not divided, claws apparently bifid (fig. 1a). Humeral callus weak. Veins R_1 and $R_4 + 5$ with long setae (fig. 1c).
 **Ornithoica** Rondani.

Subfamily ORNITHOMYINAE

Characterized by having functional wings and halteres; antennal pits open; aristae lamella-like; eyes large; thorax moderately flattened; humeral calli strong and projecting forward (fig. 6a), except in *Ornithoica*; apical portion of claws divided, apparently the claw is trifid (fig. 2a), except in *Ornithoica*; tibiae and tarsi with sensoria and/or sensilla and tarsomeres 2-5 lacking tactile setal patches; abdominal spiracle 6 distinctly apart from the anus.

Species in Hawaii are parasites on birds.

Tribe ORNITHOMYINI

Differentiated by having the cubital cell present in wing (fig. 1b) and by having well-developed ocelli, also first sternum of abdomen large, moderately sclerotized. The antennae of the Hawaiian species are confluent at bases or only narrowly separated.

Two genera in Hawaii fit here.

Genus **ORNITHOICA** Rondani

Ornithoica Rondani, 1878, Annali Mus. civ. stor. nat. Giacomo Doria 12:59.

Type-species, *beccariina* Rondani, by monotypy, = *confluenta* (Say).

Anthoica, error.

Ornithoeca, emendation.

Differentiated by having the antennae situated in a single frontal cavity, with the basal segments confluent, not separated by an interantennal area (fig. 1c). Tip of claw not divided, claws apparently bifid (fig. 1a). Third antennal segment rounded, about as wide as long and the antennae slightly diverging, not extending to tips of palpi and with three strong bristles on outer third (fig. 1c). Vertical bristles situated on strong tubercles (fig. 1d). Humeri not produced into forward directed callosities and veins R_1 and $R_4 + 5$ with long setae (fig. 1b).

For a world revision refer to Maa (1966).

Only one species has been recorded from Hawaii.

Ornithoica vicina (Walker) (figs. 1a-e)

Ornithomyia vicina Walker, 1849, List. Dipt. Colln Br. Mus. 4:1144.

Ornithoica confluenta var. *peroneura* Speiser, 1902, Fauna Hawaiiensis 3(2):91.

Type-locality: Kona, Hawaii.

For other synonymy refer to Maa (1966:44).

Hawaii, Kauai, Oahu, and no doubt on other islands. First collected 1892 (Grimshaw 1901:77, as Hippoboscidae sp.?, on short-eared owl). Immigrant. Widespread over the New World.

Erroneously recorded in the Hawaiian literature as *O. pusilla* Schiner (Hardy 1952b:482).

Hosts: Apparently a general parasite on many different birds. In Hawaii it has been recorded on the following immigrant birds: barn owl (*Tyto alba pratincola* Bonaparte), house sparrow (*Passer domesticus* Linnaeus), Japanese white-eye (*Zosterops japonica* Temminck and Schlegel), pheasant (*Phasianus colchicus torquatus* Gmelin), and parakeet (*Melopsittacus undulatus* Shaw). It has also been collected on the following endemic birds: *Asio flammeus sandwichensis* (Blox.), the iiwi (*Vestiaria coccinea* Forster), and the Kauai amakiki (*Loxops virens stejnegeri* Wilson). For a detailed list of recorded host species refer to Maa (1969:263).

Fitting in the group of species characterized by having four complete tergal plates on the dorsum of the abdomen, the sixth tergum of the female not divided, and cells R_5 and M_2 almost completely filled with setulae (fig. 1b). It fits near *turdi* (Latreille) from Europe and Africa but differs by having the spinules, "anchor-like spines," near the apex of the female abdomen scattered, about as large as those near the third spiracle, rather than having the spinules at apex of abdomen much smaller than those near the third spiracle and originating from a common multispinose wart at site of urogenital openings. Male with a separate small sclerite ("laterite") at each side of segment 6, rather than lacking this sclerite and cubital cell about 2.5 times longer than wide, rather than 2 times as long as wide.

It is readily differentiated from other Hawaiian Hippoboscidae by the generic characters given above.

The head is as in figures 1c, d. The gular spines are well developed and in two irregular rows. The humeri are rounded, not at all produced and the

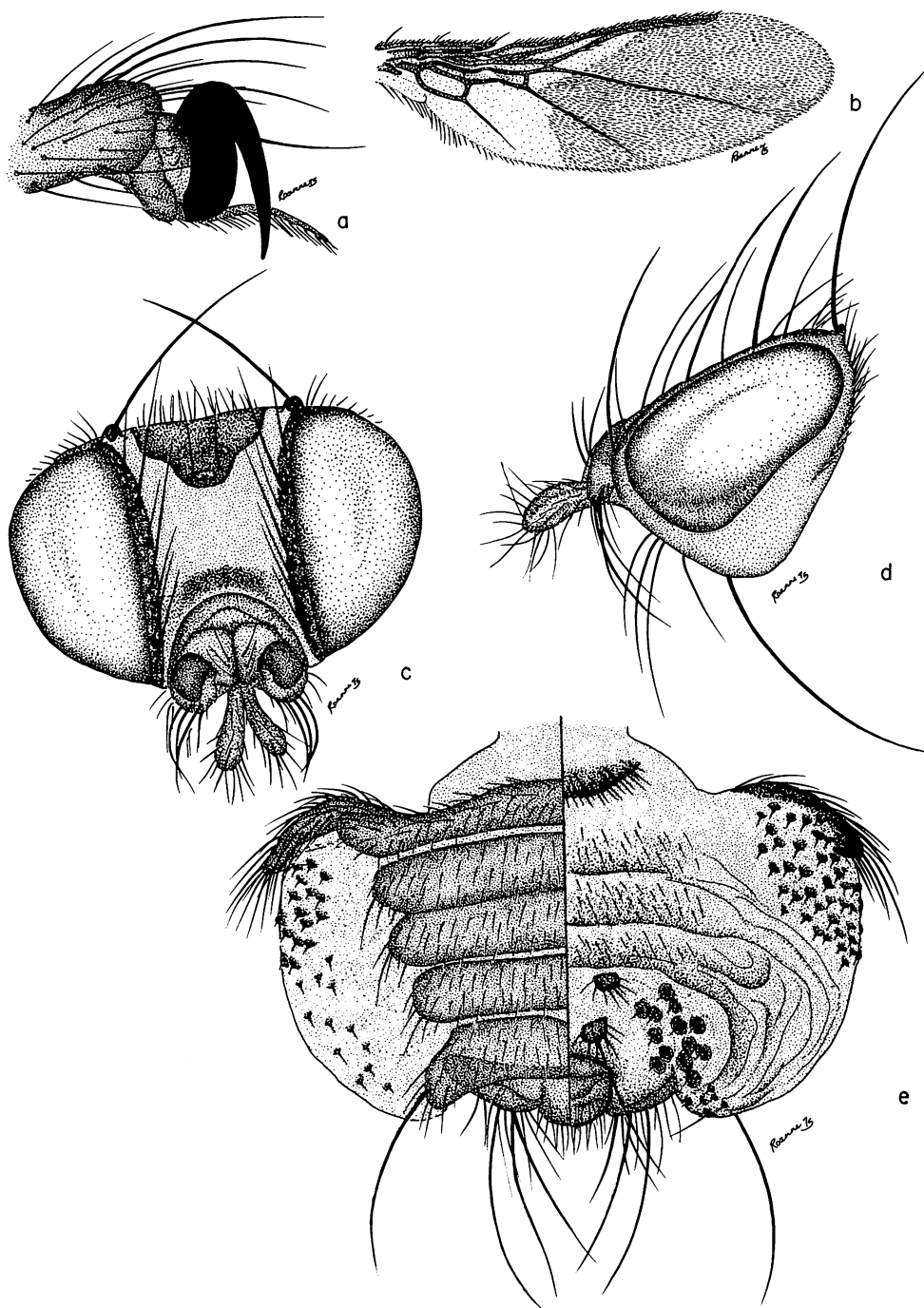


Figure 1—*Ornithoica vicina* (Walker): a, tarsal claw, hind leg; b, wing; c, head, front view; d, head, lateral; e, abdomen of female, dorsal and ventral views.

scutellum broadly triangular on hind margin, sides tapered to a point and bearing four long slender dorsal bristles. Tarsal claws as in figure 1a. Hind trochanter of male with a cluster of spines on posteroventral surface. Abdomen of female from dorsal and ventral views as in figure 1e.

Length: wing, 2.7–3.3 mm.; body, 2.25–2.6 mm.

For more detailed information refer to Maa (1966:44).

Genus **ORNITHOCTONA** Speiser

Ornithoctona Speiser, 1902, Természetr. Fü. 25:328. Type-species, *Ornithomyia erythrocephala* Leach, by original designation.

Ornithopertha Speiser, 1902, Z. syst. Hymenopt. Dipterol. 2:167. Type-species, *Ornithomyia nitens* Bigot, by monotypy.

Characterized by having third antennal segment broad, leaf-like, about three times longer than wide, extending well beyond apices of palpi and rather densely setose (fig. 2d). Antennae arising from separate pits separated by a narrow interantennal area, basal segments fused with lunule. Tip of claws divided, claws apparently trifid (fig. 2a). Vertical bristles not situated on tubercles. Wing veins bare except for hairs on base of costa.

Only one species has been recorded from Hawaii.

For a revision of the genus and key to species refer to Maa (1969:10–23).

Ornithoctona hulahula Maa (figs. 2a–d)

Ornithoctona hulahula Maa, 1969, Pacif. Insects Monogr. 20:17.

Endemic. Hawaii (Type-locality: Olaa). Molokai.

The taxonomic status of this species has been totally confused in the Hawaiian literature. It was first recorded by Grimshaw (1901:77) as an unnamed Hippoboscidae, collected on Molokai 1893. Speiser (1902:89) recorded it as *Ornithomyia varipes* Walker; Bequaert (1941:262) recorded it as *Ornithomyia metallica* Schiner; Hardy, D. E. (1952b:481, on the authority of Bequaert) listed it as *Ornithoctona australasiae* (Fabricius) and Bequaert later considered this most probably to be *Ornithoctona fusciventris* (Wiedemann).

Hosts: Unknown.

Fitting very close to *australasiae* (Fabricius) but differentiated by having the side pieces of the sixth tergum unusually large (ca. 0.36 mm wide), separated by less than their own width from one another and each bearing five very strong bristles; the membranous area between the plates is entirely bare (fig. 2c). In *australasiae* and other related species the side pieces are small (ca. 0.20–0.23 mm in width), widely separated, bearing 2–4 moderately strong bristles and the membranous area in between is setose (ref. figs. 24, 25, Maa 1969:17). The basal papillae of the bristles at sides and apex of abdomen are comparatively large, about equal in size to the spiracles in *hulahula*, rather than

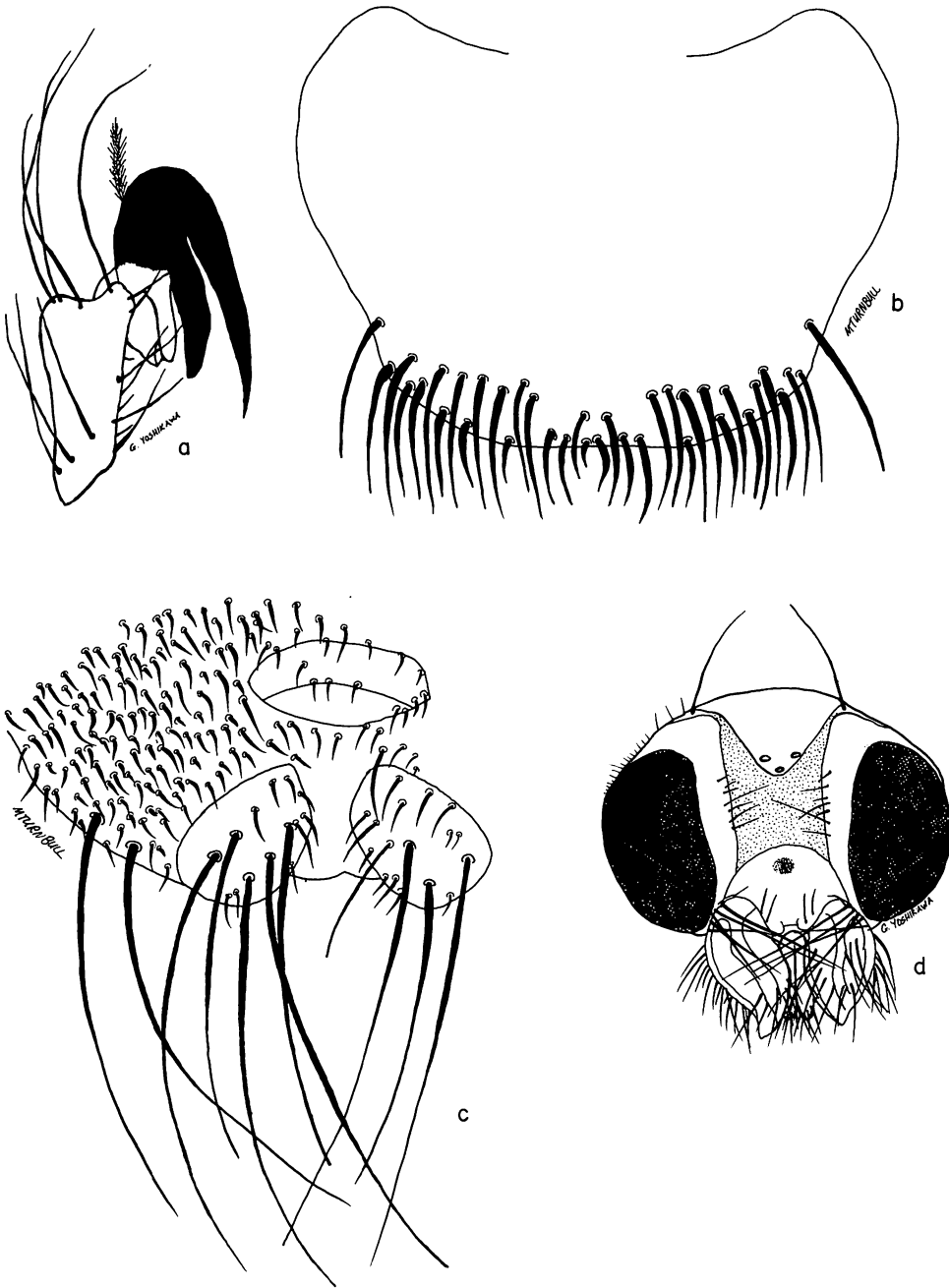


Figure 2—*Ornithocona erythrocephala* (Leach): a, tarsal claw, hind leg; d, head, front view (copied from Bequaert 1954:201). *O. hulahula* Maa: b, basal sternum, female abdomen; c, apex of female abdomen, dorsal (copied from Maa 1969:15, 17).

about 1/2 the size; and first sternum wider than long (fig. 2b), rather than longer than wide in *australasiae* (ref. fig. 13, Maa 1969:15).

For a complete description refer to the original.

Known only from the female.

Length of wing, 7.4 mm.

Tribe OLFERSIINI

Differentiated by lacking the cubital cell (figs. 3b, 4b) and ocelli; the antennae are situated in pits which are rather widely separated by the interfrontal area (figs. 3a, 4a) and first sternum small, weakly sclerotized.

Three genera represented in Hawaii.

Genus ICOSTA Speiser

Icosta Speiser, 1903, Z. syst. Hymenopt. Dipterol. 5:358. Type-species, *Olfersia dioxyrhina* Speiser, by monotypy.

Olfersia of authors, not Leach.

Lynchia of authors, not Weyenbergh.

For synonymy refer to Maa (1969:28).

Differentiated from *Olfersia* by having the interocular area of head normal in shape, with a relatively short postvertex separated from the frons by a long mediovertex (fig. 3a); lunule partly or completely divided by a suture from the interantennal area and arms of frons widely diverging; scutellum convexly curved on hind margin and with a pair of widely spaced, preapical bristles (fig. 3d); metapleurotergal callus simple, weakly swollen and strongly spined, also hind tibiae with both sensory pores and sensillae.

For more detailed description refer to Maa (1969:30).

Subgenus ORNITHOPONUS Aldrich

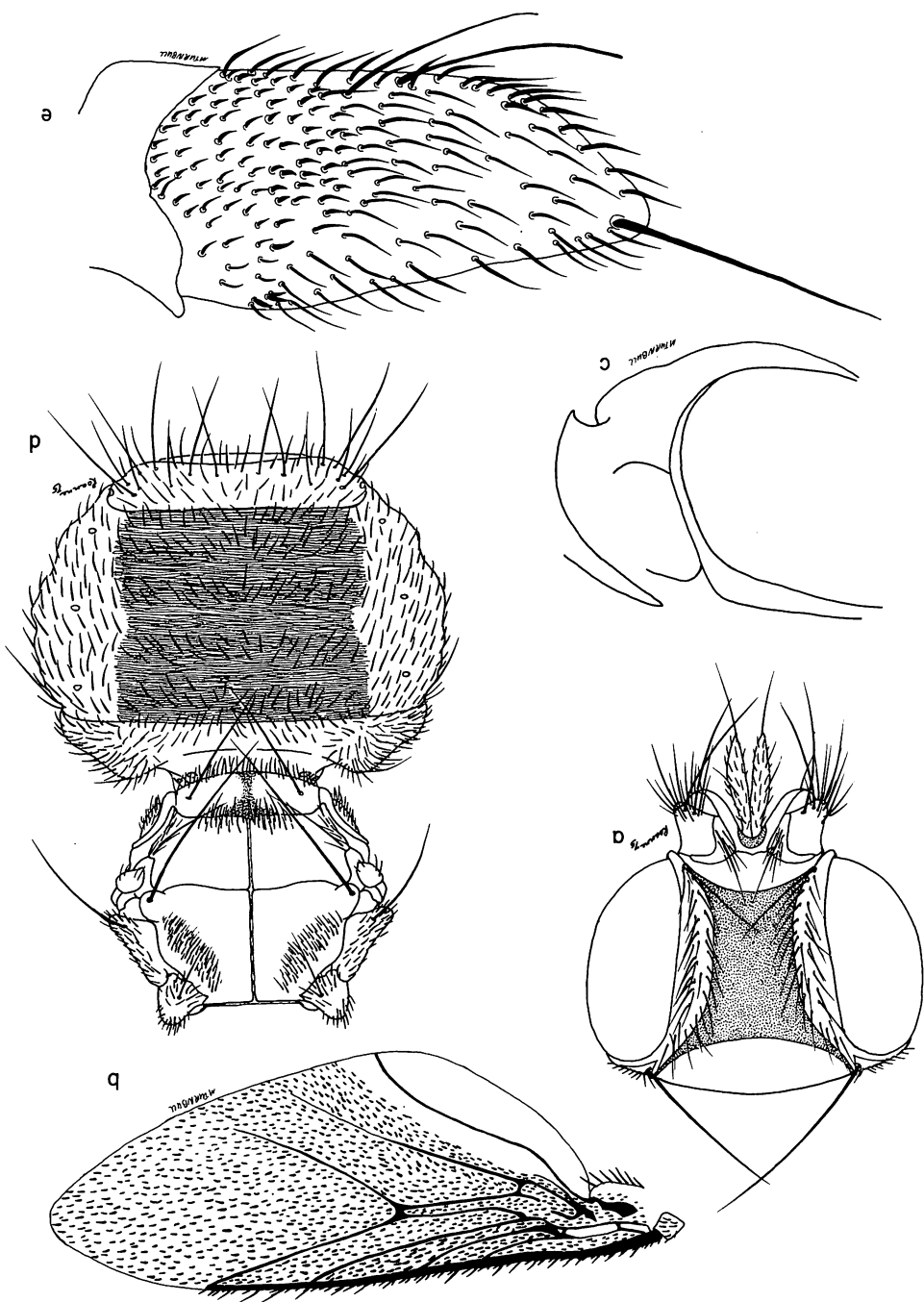
Ornithoponus Aldrich, 1923, Insecutor Inscitiae Menst. 11:77. Type-species, *Feronia americana* Leach, by original designation.

According to Maa (1969:39-41) it is differentiated from *Icosta* s.s. by having the "vibrissal area anteroventrally rounded-off (seldom angular or subangular) never tooth-like, never separated from frontal process by deep incision; frontal process apically rounded (occasionally—in Simplex group—submembranous and tooth-like), and in dorsal view, never exceedingly broad at basal 2/3 and then suddenly narrowed apicad; metabasisternum never produced into posterolateral processes; posterior scutellar margin fairly strongly convex; tarsus 1 never apically asymmetrical."

Icosta (*Ornithoponus*) *nigra* (Perty) (figs. 3a-e)

Hippobosca nigra Perty, 1833, Insecta brasiliensia. In Delectus animal. articul. quae in itinere per Brasiliam 1817-1820:190.

Figure 3—*Icosia nigra* (Perty): a, head (from Bequaert 1955:317); b, wing; c, frontal and vibrissal processes of head, dorsolateral view (copied from Maa 1969:36); d, thorax and abdomen, dorsal (from Bequaert 1955:317); e, palpus, lateral (from Maa 1969:34).



Olfersia acarta Speiser, 1902, Z. syst. Hymenopt. Dipterol. 2:149, also 1902, Fauna Hawaiiensis 3(2):87. Type-locality: Kona, Hawaii.

For complete synonymy refer to Maa (1969:58).

Hawaii, Lanai, and probably on other islands. First collected in 1892 by Perkins on a short-eared owl.

Immigrant. Nearctic and Neotropical.

Hosts: In Hawaii it has been collected on the endemic owl, *Asio flammeus sandwichensis* (Blox.). For other hosts refer to Maa (1969:59). Maa (*op. cit.*:278) says it occurs chiefly on Falconiformes.

According to Maa (1969:59) *I. nigra* differs from all American species because of its larger size. "Vibrissal area subangular, inner orbit and thoracic dorsum more richly setose, palpus longer, and female laterite 7 well developed." It is most closely related to *dukei* (Austin), from Africa but differs by lacking the third tergum in both sexes; prosternum broader than long and with only a few fine, pale hairs; laterocentral setae of prescutellum fine, pale, and partly reaching the transverse suture of the mesonotum. The head as seen in dorsal view is shown in figure 3a. The frontal and vibrissal processes in profile as in figure 3c, and the palpus as in figure 3e. Wing as in figure 3b and abdomen, dorsal view, as in figure 3d.

Length: body, 6.0–7.0 mm.; wing, 7.5–8.5 mm.

For a detailed discussion of this species refer to Bequaert (1955:314) and to Maa (1969:58).

Genus **OLFERSIA** Leach

Feronia Leach, 1817, On the genera and species of eproboscideous insects, Edinburgh, p. 4. Type-species, *spinifera* Leach, by monotypy. Refer to Maa (1969:283) for other synonyms.

Olfersia Leach, 1817, in Brewster, The Edinburgh Encyclopaedia 12:11. New name for *Feronia* Leach.

Fitting near *Icosta* Speiser but the head development is very different (fig. 4a). It is differentiated by having the interocular area about evenly divided by the ptilinal suture, the lunule and interantennal area (frons) fused into one broad sclerite and the apical arms of the frons contiguous for most of their length, not widely diverging. Also, the scutellum nearly straight on hind margin and lacking bristles; metapleurotergal callus with a prominent, finger-like projection at apex and lacking spines. Puparium uniformly spiny.

For more descriptive details refer to Bequaert (1957:418).

Olfersia aenescens Thomson (figs. 4a–b)

Olfersia aenescens Thomson, 1869, K. svenska fregatten Eugénies Resa, Zool., Dipt. 2:610.

Northwestern Hawaiian Islands, Laysan, French Frigate Shoals, and Lisiansky; also Oahu.

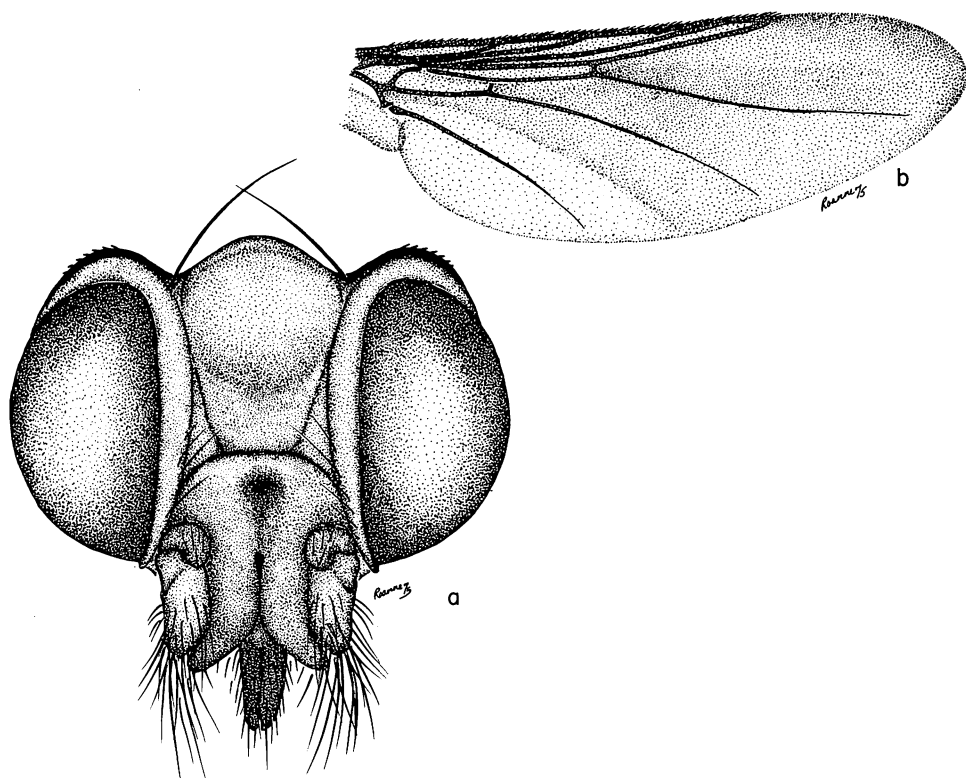


Figure 4—*Olfersia aenescens* Thomson: a, head; b, wing.

Immigrant. Pantropical over the Pacific, Atlantic, and Indian oceans.

Hosts: In the Hawaiian islands it has been collected on shearwaters and noddy terns on Rabbit Island, off Oahu (Pemberton 1947) and from the Laysan albatross, *Diomedea immutabilis* Roths.; the red-tailed tropicbird, *Phaethon rubricauda* Bodd.; the red-footed booby, *Sula sula* Linn.; and the sooty tern, *Sterna fuscata* (Bloxam) on French Frigate Shoals (Maa 1968:325).

Refer to Maa (1969:284) for a complete list of recorded hosts. *O. aenescens* is a specific parasite for oceanic fish-eating birds, boobies, terns, tropicbirds, petrels, shearwaters, noddies, and more rarely albatross.

Fitting near *spinifera* (Leach) in the group of species which have the orbits well-developed behind posterior margin of eyes, approximately as wide as inner orbits; postvertex strongly produced and extending from occiput to ptilinal suture but divided by a slightly transverse depression into an upper polished black area and a lower grayish pruinose area; the postvertex is separated from upper orbits by a rather deep concavity, or notch, on each side. Also, vein $R_4 + 5$ is at least partially setose on upper side. *O. aenescens* differs from *spinifera* by having the hind margin of the postvertex not so strongly produced, extend-

ing scarcely beyond level with upper orbits and the transverse depression of postvertex slightly curved and placed below the mid length (fig. 4a); upper orbits slightly longer than in *spinifera*, about as long as greatest width of inner orbits and more distinctly grooved transversely; first antennal segment incompletely separated behind from the sides of the lunule; crossvein m transverse or nearly so and cell 1st M_2 nearly square at apex (fig. 4b); vein $R_4 + 5$ bare except for a few setae above near apical portion and posterior portion of wing, through cells A, Cu, and lower half of M_4 with microtrichia on upper surface. Slightly smaller in size than *spinifera*, the wing ranges from 6.5–8.0 mm.

For a detailed discussion refer to Bequaert (1957:437).

Olfersia spinifera (Leach) (figs. 5a–b)

Hippobosca nigra Osbeck, 1757, Dagbok öfver en Ostindisk Resa (1750–1752), p. 297. Pre Linnean, *Nomen nudum*.

Ornithomyia pelecani liscatoris v. Olfers, 1816, De Vegetativis Animatis in Corporibus Animatis Reperiundis 1:103. *Nomen nudum*, with “*Hippobosca nigra* Osbeck” as synonym.

Feronia spinifera Leach, 1817, Gen. Spec. Eproboscideous Ins., pp. 6, 11, pl. 26, figs. 1–3. For synonymy refer to Bequaert (1957:429).

Widespread over the Northwestern Hawaiian Islands and probably throughout the chain on frigate birds.

Immigrant. Pantropical over the Pacific, Atlantic, and Indian oceans.

Hosts: In the Hawaiian islands it has been collected only on frigate birds (*Fregata minor palmerstoni* Gmelin). Refer to Maa (1969:285) for recorded hosts from other areas.

Fitting in the same group with *aenescens* Thomson and differing by having the posterior margin of the postvertex more strongly developed, extending well beyond level with the upper orbits, the latter are distinctly narrower than the inner orbits at their widest point. The transverse depression across the interocular area is nearly straight and placed approximately at the middle (fig. 5a); first antennal segment usually completely separated from the fused frons and lunule. Crossvein m oblique so that the upper apical portion of cell 1st M_2 is pointed and posterior portion of wing lacking microtrichia on both upper and lower surfaces of membrane (fig. 5b).

Slightly larger species, wing, 7.0–9.5 mm.

For more descriptive details refer to Bequaert (1957:429).

Genus PSEUDOLYNCHIA Bequaert

Pseudolynchia Bequaert, 1926, Psyche (1925) 32:271. Type-species, *Olfersia maura* Bigot, by original designation, = *canariensis* (Macquart).

Lynchia, of authors, not Weyenbergh.

Differentiated from other Olfersiini by having only the r-m crossvein present in the wing (fig. 6b), the other crossveins are lacking; scutellum straight on

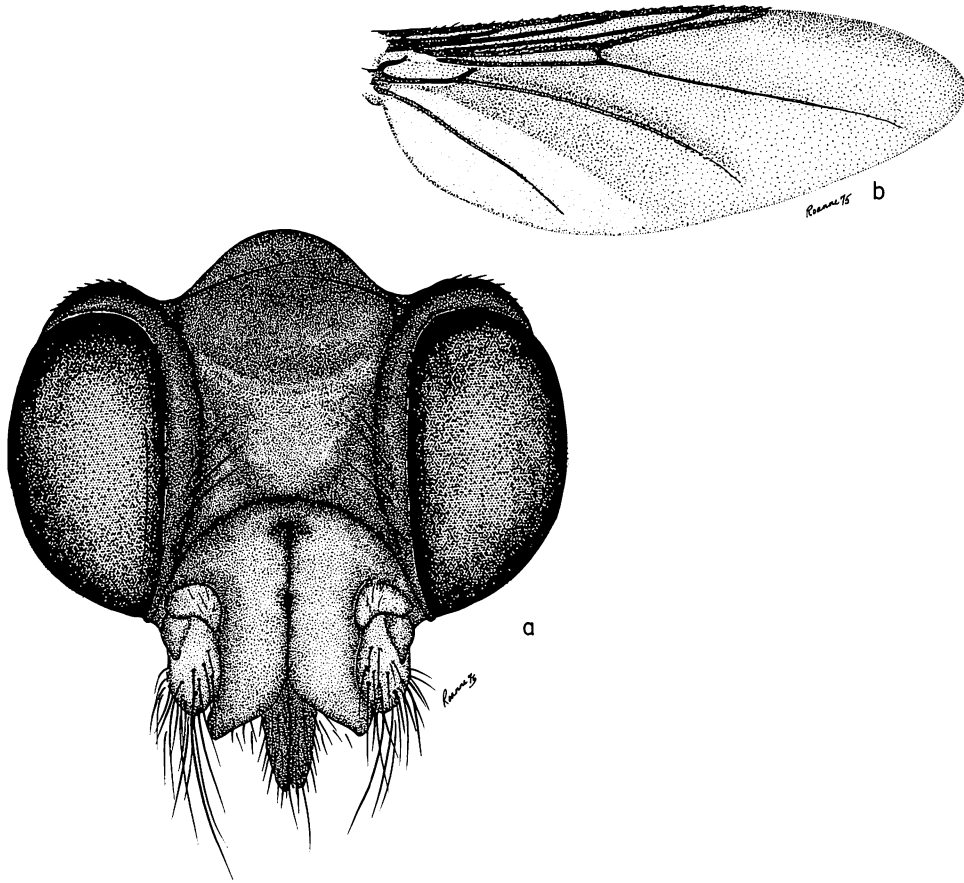


Figure 5—*Olfersia spinifera* (Leach): a, head; b, wing.

hind margin and with pale finger-like processes on posterolateral margins (fig. 6g), and the mesonotum with numerous strong, anterolateral bristles which extend to or beyond the suture. Also, the metapleurotergal callus is weakly swollen, not conical; the metasternal process is well developed; the frontal processes are broadly rounded apically as seen in profile and the vibrissal area is acutely projected forward; scutellar bristles are present.

For a detailed description refer to Bequaert (1955:387) and to Maa (1966:125).

As discussed by Maa it is closely related to *Microlynchia* Lutz and its only unique character is the presence of finger-like processes on the scutellum.

***Pseudolynchia canariensis* (Macquart) (figs. 6a–e)**

The Pigeon Fly

Olfersia canariensis Macquart, 1839, Diptères, in Webb, P. B., and S. Berthelot, eds., Hist. nat. des Iles Canaries. 2(2), Zoologie [Sect. 6]:119.

Olfersia maura Bigot, 1885, Ann. Soc. Ent. France, ser. 6, 5:237.

For other synonyms refer to Maa, in Delfinado and Hardy (1977:415).

Widespread over all the main islands. First recorded in 1911 (Swezey 1912). Known in the earlier Hawaiian literature as *Lynchia maura* (Bigot). Corrected in 1952 (Hardy 1952:482).

Immigrant. Nearly cosmopolitan, wherever domestic pigeons are present.

Hosts: Common on pigeons. For complete host list refer to Maa (1969:282).

Fitting in the group of species which have the posterior portion of the wing largely bare of microtrichia and with a conspicuous longitudinal bare streak through cell M_2 just above vein $M_3 + 4$ (fig. 6b). It is nearest to *garzettae* (Ron-dani), from Southeast Asia and Africa, and the two are differentiated by the following characters given by Maa (1966:126):

“ . . . median length of scutellum ca. $1/4$ interdistance of bases of scutellar bristles; hind scutellar margin, in dorsal view of insect, straight or virtually straight; interantennal area of frons as wide as or rarely slightly narrower than its distance to eye; prescutum with 20–30 long pale fine setae and before which with 2–3 series of shorter ones; male mid tarsus with groups of peg-like modified spines under segment 1 at base . . .

..... **canariensis**
Median length of scutellum ca. $1/3$ interdistance of bases of scutellar bristles; hind scutellar margin in dorsal view of insect, weakly but distinctly curved; interantennal area of frons always much narrower than its distance to eye; prescutum with 12–18 long, fairly robust, and generally black setae and before which with 1–2 series of shorter ones; male mid tarsus with only pointed setae under segment 1 at base **garzettae**”

The head is shaped as in figures 6c, d. Most of the head bristles and setae are yellow except for those on the antennae, the vibrissal prominence and oral margin, and for some on palpi. The vertical bristles are very long, slightly longer than those on the anterolateral margins of the mesonotum and the inner orbits are rather densely long haired. The arms of the frons are widely divergent as seen in dorsal view and are broadly rounded at their apices as seen from lateral view (fig. 6c). The vibrissal prominence is acute. The palpi are rather elongate, extending the full length of the frons and lunule, beyond the apices of the arms of the former. Proboscis long and slender (fig. 6c). Humeri rather conical with two black dorsal bristles and a clump of black spinules at apex. Mesonotum and scutellum as in figure 6a. Except for the humerals, one

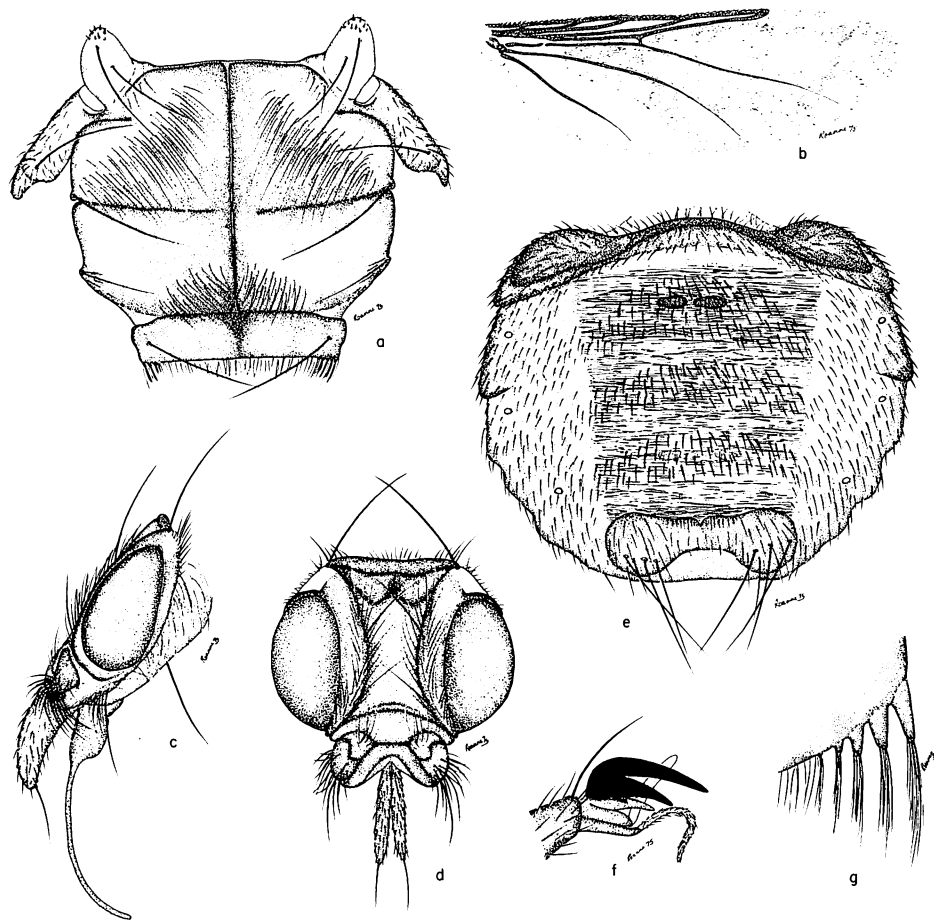


Figure 6—*Pseudolynchia canariensis* (Macquart): a, thorax, dorsal; b, wing; c, head, lateral; d, head, frontal; e, abdomen of female, dorsal; f, claw of hind leg; g, enlargement of lateral setae at apex of scutellum.

pair of notopleurals, one pair of prescutellar dorsocentrals, and one pair of black scutellars, all other bristles and setae are yellow. Mesopleuron (anepisternum) with one strong bristle and several black setae near posterodorsal margin, pleurotergon with a row of black bristles on hind margin, also one black bristle on upper hind margin of sternopleuron (katepisternum), otherwise other setae of pleura yellow. The tarsal claws are shaped as in figure 6f. Wing venation as in figure 6b. The veins are bare and the hind portion of the wing is devoid of microtrichia, also a long narrow bare strip occurs through cell M_2 just above vein $M_3 + 4$. The female abdomen as seen in dorsal view is as in figure 6e.

Length of wing, 5.8–7.5 mm.

For further details refer to Bequaert (1955:390) and to Maa (1966:128).

Subfamily LIPOPTENINAE

Characterized by lacking wings, halteres, and also ocelli, in the Hawaiian species. Also by having the head short and broad; palpi elongate; antennal pits closed and antennae flush with front (fig. 7). In addition the antennal appendages are very small and the bases are fused with the lunule; the aristae are branched; the front is not produced into apical arms or processes; eyes are small; the lunule is fused with the front; humeral callus weak; anterior thoracic spiracles dorsal; metapleurotergal callus weak; claws simple; tibiae and tarsi lacking sensoria or sensilla; tarsomeres 2-5 with tactile setal patches; abdomen lacking a dorsal striolate area and abdominal spiracle 6 situated close to anus.

Hosts: Artiodactyla.

For a revision refer to Bequaert (1942).

Genus **MELOPHAGUS** Latreille

Melophagus Latreille, 1802, Hist. nat. Crust. Ins. 3:468 pp., in Sonnini, C. S., ed., Hist. nat. Buffon "An X." Type-species, *Hippobosca ovina* Linnaeus, by monotypy.

For synonymy refer to Bequaert (1942:157).

In Hawaii this is readily recognized by the subfamily characters. Maa (1969:235) keys it near *Neolipoptena* Bequaert and gives the following differentiating characters:

"Wing replaced by permanent solid subcylindrical knob; haltere absent; meso- and metasterna subequal in length; mesopleuron strongly constricted between coxae 1 and 2; sutures of mesonotum obliterated, anepisternum incompletely separated from prescutum, transverse mesonotal suture absent, scutoscutellar suture incomplete; prosternum lengthened; eye quite long and narrow; ♀ pregenital and postgenital plates bare; pulvilli all vestigial; (♂ with none or 1, ♀ with none or 2 entire median tergal plates; sternite 1 distinctly bilobed posteriorly; eye laterally far from reaching margin of head; both thoracic spiracles roundish, anterior one larger than posterior; no suture separating mesepisternum from mesepimeron; remnant of tergite 1 transversely linear; posterior claws slightly shorter than corresponding anterior claws, with well-defined "heels"; ♀ infra-anal plate normal, not shortened; pronotum not constricted or interrupted at middle; posterior mar-

gin of metasternellum angularly notched and slightly depressed at middle; longitudinal intra-scutal groove indistinct; posterolateral corner of pleurite 1 angulate; female pregenital plate single, anteriorly fenced by setae; male parameral apodeme sclerotized; ocelli always absent; tibiae relatively stout). Palaearctic Region; on Bovidae . . .
 **Melophagus** Latr.’’

Melophagus ovinus (Linnaeus) (fig. 7)

The Sheep Ked

Hippobosca ovina Linnaeus, 1758, Systema nat. Ed.10, 1:607.

Hawaii, Oahu, and Kahoolawe. First recorded January, 1927 (Muir 1928),
 Nearctic, Neotropical, and Palaearctic regions.

Host: Sheep.

Bionomics: The entire life of the fly is spent on its host. The mature larvae are laid in the wool, usually in the region of the shoulders, thighs, or belly, and the secretion with which they are covered hardens so that the pupae are glued firmly to the wool. The pupa requires about three weeks for hatching and the females reach sexual maturity in two to four weeks and begin extruding mature larvae at the rate of one every seven or eight days. They live an average of about four months and the female produces ten to twelve offspring during this time. The irritation caused by heavy infestations of the keds causes the sheep to rub, bite, and scratch at the wool, seriously reducing the value of the fleece; the animals become unthrifty, feed poorly, and lose weight. The injury to lambs is especially marked, resulting in lack of growth, unsatisfactory fattening, and in reduced vitality.

This species is characterized from other *Melophagus* by having the palpi very elongate, about as long as head and at least two times longer than frons; inner orbits with about 20 setae, including 1 vertical bristle; male abdomen lacking median tergal plates and female with only the 7th tergum present. The characteristics, as seen in dorsal view, are as in figure 7.

Superfamily MUSCOIDEA

Family ANTHOMYIIDAE

This group has commonly been treated as a subfamily under Muscidae and was combined with that family in the key to families of Hawaiian Diptera (Hardy, D. E. 1960a:36). More recent works treat it as a distinct family separated from Muscidae by having vein $Cu_1 + 1st\ A$ extended to wing margin (although apical portion sometimes very thin) (figs. 9a, 10a). Also, the lower calypter is not longer than the upper. Except in *Fucellia* Robineau-Desvoidy, the Hawaii species may also be recognized by having fine hair on the venter of the scutellum. This is a very useful character for separating most anthomyiids.

These are moderately small, dark-bodied flies resembling many species of

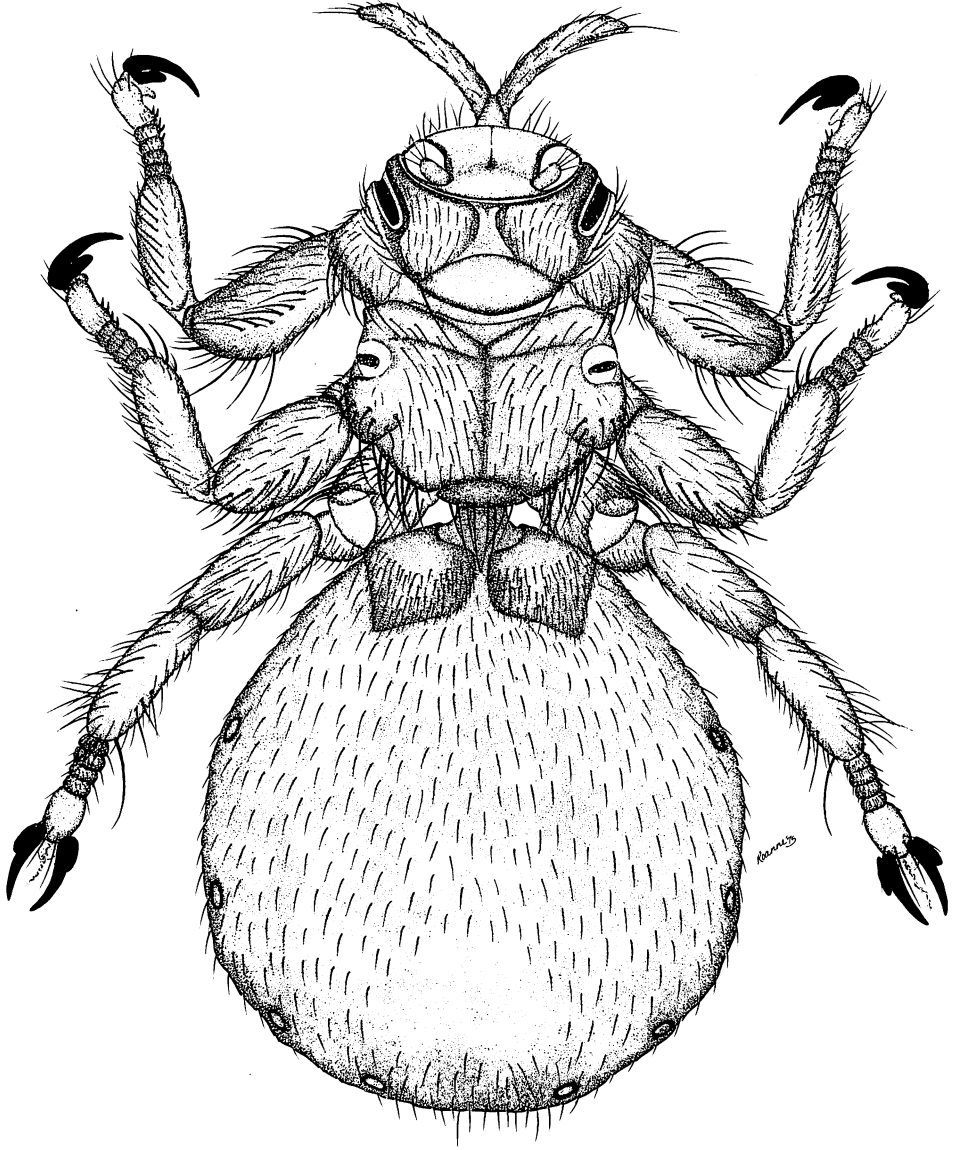


Figure 7—*Melophagus ovinus* (Linnaeus): body of female, dorsal.

muscsids except for the above characters. The larvae are mainly phytophagous and saprophagous. Many of the larvae mine foliage of various plants and may do serious damage.

Three genera have been recorded from the Hawaiian archipelago and are differentiated by the following key (adopted from Hockett 1971).

- Fucellia boninensis* Snyder, 1965, Insects of Micronesia 13(6):204. Type-locality: Omura, Chichi Jima, Bonin Islands. Type male in U.S. National Museum.

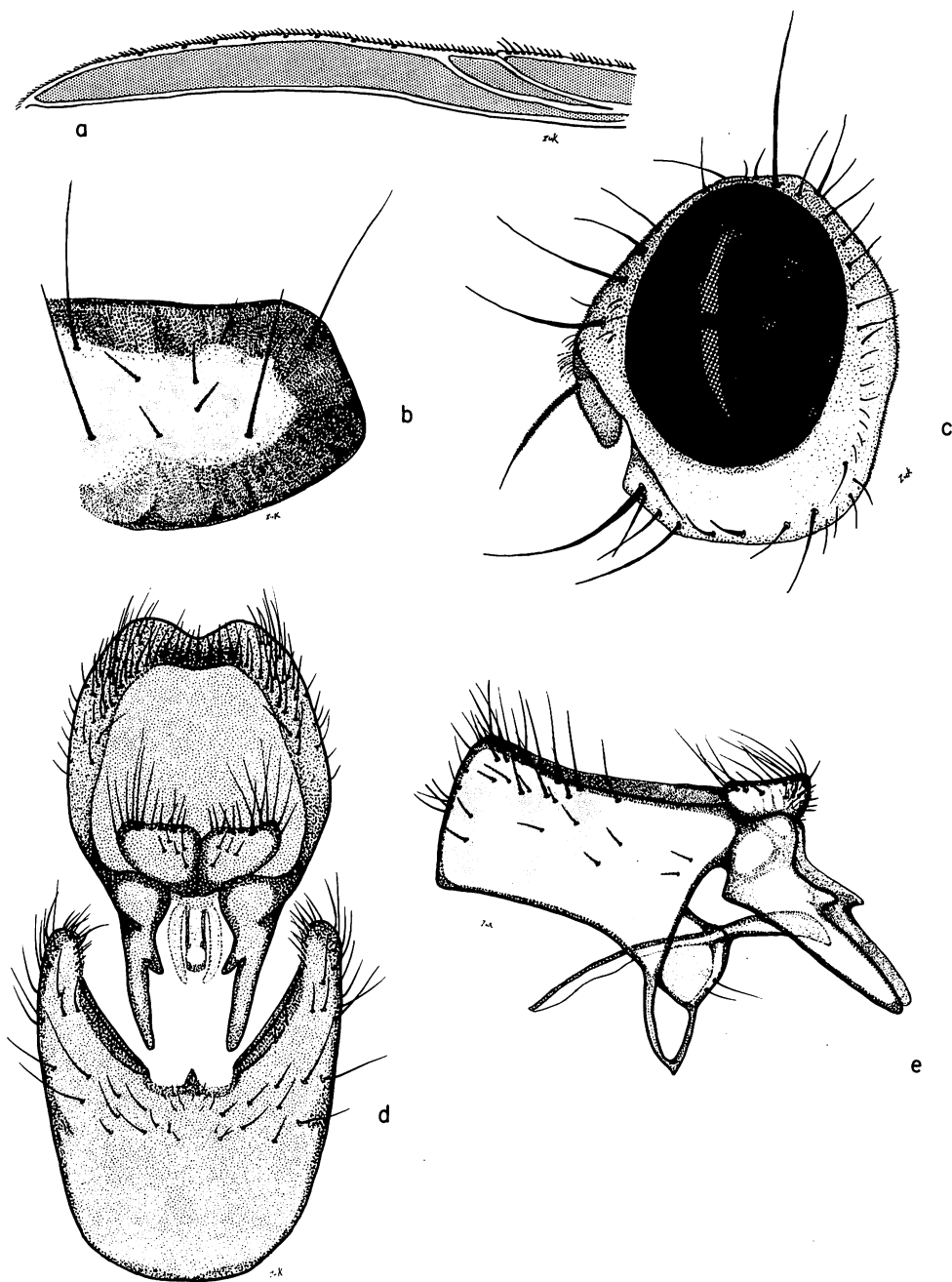


Figure 8—*Fucellia boninensis* Snyder: a, costal margin of wing; b, sternopleuron; c, head, lateral; d, male genitalia, end view, showing fifth sternum in ventral view; e, male genitalia, lateral.

Midway Atoll. First recorded by Suehiro (1960:296) as *Fucellia* sp. The earliest collection date is August 1956. Probably spread over the Northwestern Hawaiian Islands and possibly on some of the main islands. Specimens have been compared with paratype specimens in the B. P. Bishop Museum and with Snyder's original description, and they fit *boninensis*.

Immigrant. Bonin Islands. Probably widespread over the Pacific.

Habits: Beach inhabitants, Snyder (*op. cit.*) said the adults "were seen only an hour or two after sunrise, or before sunset, resting on sand, fish scales, and small twigs of driftwood."

Snyder said that *boninensis* "appears to be very closely allied to the western North American *aestuum* Aldrich (1918, Calif. Acad. Sci., Proc. IV, 8:118) but that species has all tibiae, as well as the basal two-fifths of palpi, darkened." In Hockett's key it runs near *rejecta* Aldrich, from the west coast of North America and from Baja and Sonora, Mexico, but differs by having short bristly setae on inner apex of each lobe of the fifth sternum (fig. 8d) rather than long bristles.

Rather nondescript, small, dark-bodied, densely gray pollinose muscoids, with a faint indication of a median brown vitta extending down mesonotum. Head shaped as in figure 8c, eyes of male widely separated, front equal in width to one eye. Six pairs fronto-orbital bristles plus a pair of strong cruciate inter-frontals. Genae broad, almost half as wide as the eye height and about equal in width to the parafrontal region. Thorax with five pairs dorsocentral bristles and with acrostichals in two distinct rows, the presuturals are bristle-like. Four strong sternopleural bristles arranged as in figure 8b (2:2). Calypters white with yellow-white fringe, the lower calypter poorly developed, very narrow not lobe-like and completely hidden by upper in resting position. Wings hyaline with normal venation: costal margin as in figure 8a. Legs mostly rufous in ground color, with femora gray pollinose and tinged with brown to blackish in ground color. Leg bristling as described by Snyder, front tibia with two posterior bristles medianly. Abdomen mostly gray pollinose with an indistinct brown median vitta. Male genitalia as in figures 8d,e. Lobes of fifth sternum densely covered with bristly setae on inner apical margins. Dorsal margin of epandrium (as seen from end view) with abundant short, closely placed bristles and each surstylus with a short median lobe on inner margin.

Length (of specimens at hand): body, 3.9–4.0 mm. Snyder measured the male length as 3.9–5.1 mm. and the female, 4.5–5.5 mm.

Subfamily ANTHOMYIINAE

Differentiated by the key characters given above

Genus ANTHOMYIA Meigen

Anthomyia Meigen, 1803, Magazin InsektKde 2:281. Type-species, *Musca pluvialis* Linnaeus, by subsequent designation (Westwood 1840:143).

Anthomyza error. Not *Anthomyza* Fallén.

Readily recognized by having the propleura setose, a distinct ventral spine near base of hind basitarsus, and in the Hawaiian species having a conspicuous brown band over middle of mesonotum (fig. 9f).

The eyes of the male almost come together on the front and the female has a pair of strong cruciate interfrontal bristles.

***Anthomyia illocata* Walker (figs. 9a-g)**

Anthomyia illocata Walker, 1856, Proc. Linn. Soc. Lond. 1:129. Type-locality: Sarawak, Borneo.

Anthomyia bisetosa Thomson, 1869, in K. Svenska fregatten Eugenie Resa, Zool. Dipt. Pt. 2 [Sec. 1], "1868":555. Type-locality: China.

On all the main Hawaiian islands. First recorded in Honolulu, April 1919 (Timberlake 1920).

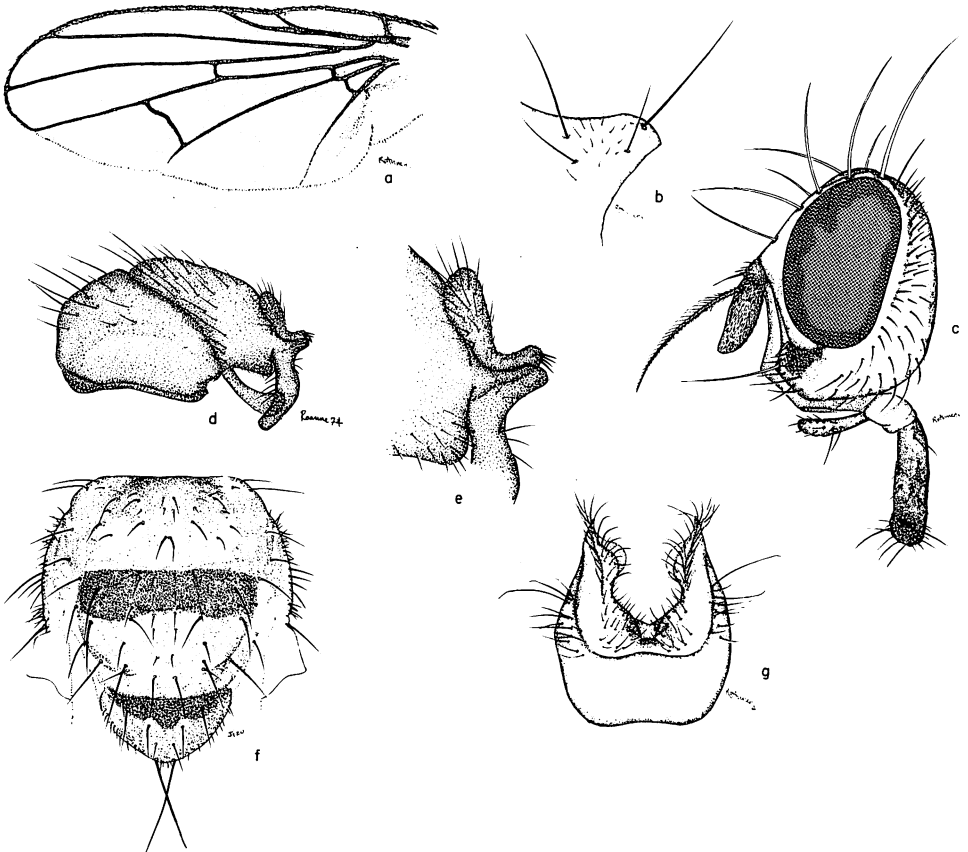


Figure 9—*Anthomyia illocata* Walker: a, wing; b, sternopleuron; c, head of female, lateral; d, male genitalia, lateral; e, anal sclerotization, enlarged; f, thorax, dorsal; g, fifth sternum of male.

Immigrant. Widespread Oriental Region, east Asia, Micronesia, and Papuan subregion.

Habits: No biological data are available for this species. The adults are frequently seen on tree trunks in bright sun.

A very distinctive species readily recognized by the silvery gray pollinose thorax with a broad, opaque brown to black crossband on mesonotum just behind suture and a brown to black basal band on scutellum (fig. 9f). The eyes of male are close together on the front, at narrowest point the frons is equal in width to the median ocellus and slightly less than the length of three rows of eye facets. Head silvery gray pollinose except for brown to black lower portion of inter-frontal area and a prominent opaque brown spot on anterior portion of each gena. Arista short plumose, with the longest hairs on the upper side (fig. 9c). Males with only two pairs of fronto-orbital bristles. Female with four pairs, the upper two are reclinate the lower pair cruciate, the second pair proclinate. Females also with a strong pair of cruciate interfrontal bristles. The sternopleural bristles arranged as in figure 9b. Propleura and first abdominal sternum setose. Fifth sternum of male shaped as in figure 9g and genitalia as in figure 9d. The anal sclerotization is bent sharply upward and has numerous short spicules at its apex. Each surstylus has a prominent dorsal lobe near base, is curved downward, broadly rounded apically (fig. 9e), and with strong bristle-like setae on inner margin.

Length of body, 4.0–5.5 mm.

Snyder (1965:206) says this is very close to the West African *fasciata* Walker and may eventually prove to be a subspecies of it.

Genus **HYLEMYA** Robineau-Desvoidy

Hylemya Robineau-Desvoidy, 1830, Mém. présentés Acad. r. Sci. Inst. Fr. (2)2:550. Type-species, *strenua* Robineau-Desvoidy, by subsequent designation (Rondani, 1866:74, 184), = *strigosa* (Fabricius).

Hylemyia, emendation.

Differentiated from other Anthomyiinae by having the propleura, hypopleura (meropleura) and pteropleura bare; lower calypter shorter than upper; eyes bare, holoptic in males; and in Hawaiian species with three pairs of postsutural dorsocentrals and with thorax and abdomen gray pollinose with three indistinct brown vittae on mesonotum and a faint median vitta down abdomen.

Subgenus **DELIA** Robineau-Desvoidy

Delia Robineau-Desvoidy, 1830, Mém. présentés Acad. r. Sci. Inst. Fr. (2)2:571. Type-species, *floricola* Robineau-Desvoidy, by subsequent designation (Coquillett, 1910:531), = *cardui* (Meigen).

Hylemyia, subg. *Crinura* Schnabl, 1911, Deut. ent. Z. 1911:71. Type-species, *Chortophila cilicrura* Rondani, by monotypy, = *platūra* (Meigen).

Huckett (1971:13, 16) differentiates the subgenus *Delia* mainly by the development and bristling of the male genitalia: "Basal sclerite of hypopygium with bristles diverse and in irregular transverse series across posterior half, becoming devoid of bristles anteriorly; anal sclerite conical in outline and not gradually appressed dorsad with stronger bristles dorsad (cephalad) [surstyli elongate, slender (fig. 10g)]; mid tibia usually with 1 posterodorsal bristle, if 2 present then dorsal area of occiput below postocular series of setulae usually bare, or nearly so." He says females "of *Delia*, with few exceptions, lack discal bristles on tergum 5 and the short upper bristle on border of mesopleura near anterior notopleural bristle, and may have only one posterodorsal bristle on mid tibia." The females have three spermathecae.

Only one species known from Hawaii.

***Hylemya (Delia) platura* (Meigen) (figs. 10a-g)**

The Seedcorn Maggot

Anthomyia platura Meigen, 1826, Syst. Besch. bekannt. europ. zweifl. In-sekt. 5:171. Type-locality: Germany.

For long list of synonyms refer to Huckett and Vockeroth, in Stone et al., 1965:826, also see Ackland and Pont, in Delfinado and Hardy, 1977:441.

Common over all of the Hawaiian islands from sea level to 6,500 feet.

Immigrant. Cosmopolitan.

This has been commonly referred to in the Hawaiian literature as *Hylemya* (usually as "*Hylemyia*") *cilicrura* (Rondani). The first reports in the Hawaiian literature (as *Pegomyia fusciceps* (Zett.) were in a report on common names of economic insects in Hawaii (Ehrhorn et al. 1913:297), a listing by Illingworth (1923d:277), and a note by Bryan (1923:291). The earliest collection date in the literature is "bred ex-beets, by Illingworth, 1916." Specimens are in the Bishop Museum collection collected on Oahu, April 1914.

Habits: The following is from Huckett (1971:35): The larvae "infest a number of cultivated vegetable crops, notably beans, corn, onions, peas, potatoes, cruciferous plants, cucurbits, lettuce, spinach, sugar beets, grains, and leguminous field crops, particularly in certain instances where seed or stems have commenced to decay; and are reported as carriers of plant disease organisms (Leach, 1926:149). Larvae have also been known to attack seedlings of certain conifers and to feed on eggs of grasshoppers."

For biological studies refer to Miles (1948, 1950, and 1952).

In Hawaii it has been bred from seeds and young plants of beets, beans, peas, melons, squash, cucumber, corn, potatoes, bulb onions, and cabbage.

References to *H. brassicae* (Wiedemann) in Hawaiian literature are based upon misidentifications of *platura*.

According to the key characters given by Huckett (1971:17-20) this species is differentiated by the following combination of characters: Males without posteroventral bristles on hind femora; apicoposteroventral bristle of front

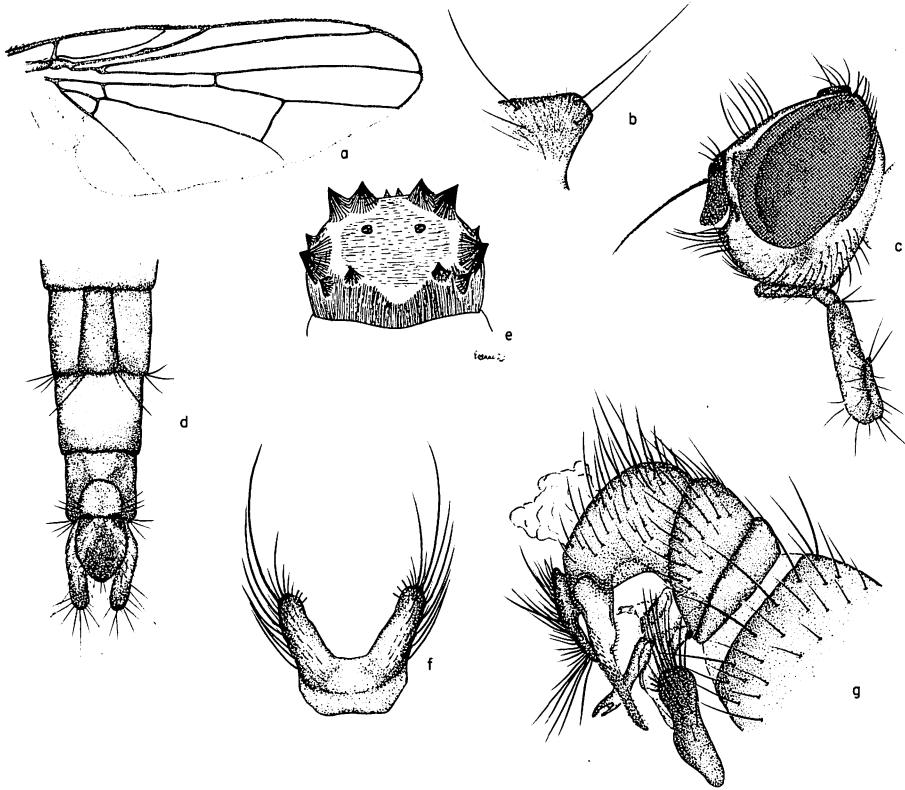


Figure 10—*Hylemya platura* (Meigen): a, wing; b, sternopleuron; c, head of male, lateral; d, female abdomen, ventral; e, larva, posterior end (from Brooks 1951:113); f, fifth sternum of male; g, male genitalia, lateral.

tibia large, blunt at apex; legs entirely dark brown to blackish; hind tibia with a row of prominent posteroventral setulae extending nearly the entire length; prealar bristles short, shorter than posteronotopleurals; arista pubescent; middle tarsus without dorsal bristles; fourth abdominal sternum not bilobed and lobes of fifth sternum without an inner marginal series of coarse setulae. Females with front tibia with preapical posterodorsal bristles well developed; front femur without semi-erect anterior setulae in middle; hind tibia often with a fine preapical posteroventral hair; arista pubescent, prealar bristles short; presutural acrostichals paired and terminal sclerites of ovipositor lacking recurved spines.

This species is immediately differentiated from other Hawaiian muscids by having vein $Cu_1 + 1st\ A$ complete, extending to costa, underside of scutellum with fine yellow hairs, in combination with mesonotum, and abdomen densely gray pollinose with three rather faint brown vittae extending down former and

one median brown vitta down latter and arista pubescent. Head as in figure 10c, with eyes of male nearly joined on front. Male with about six pairs of fronto-orbital bristles and females with a pair of strong cruciate interfrontals. Acrostichal setae arranged in two distinct rows the full length of the thorax. Bristles of sternopleuron as in figure 10b. Two presutural and three postsutural pairs of dorsocentral bristles. Prealar bristles small, only about two times larger than the setae of mesonotum. Fifth sternum of male as in figure 10f. The surstyli are long and slender and the aedeagus is bifid at apex. Other details of male genitalia as in figure 10g. Female ovipositor as in figure 10d. Posterior portion of larva as in figure 10e.

Family MUSCIDAE

A large family of variable, moderate-sized flies, typically dark colored, with gray markings. Characterized from other muscoids by lacking hypopleural bristles; vein $Cu_1 + 1st\ A$ not extending to wing margin; lower calypter longer than upper and ventral portion of scutellum bare.

The larvae are predominantly scavengers, or predators, living in a wide assortment of rotting organic matter; some are phytophagous and some are commensals, or may actually feed on the blood of living animals. The adults have a broad range of habits from blood sucking, predation, filth inhabiting to flower feeding. Many species are of medical (ref. Greenberg 1971 and 1973) and veterinary importance and some are destructive to agricultural crops.

The arrangement of the subfamilies and tribes follows that of Hennig (1965) and also of Vockeroth (1972:3). Hennig's classification is based mostly on the structure of the female ovipositor and, as pointed out by Vockeroth, these are obviously very important indicators of relationships within the Muscidae but usually cannot be studied *in situ* and should be supported by other characters common to both sexes. Following the Hennig concepts it is not possible to prepare a generic key based upon characters present in both sexes where the genera can be handled in distinct subfamily groups. The key below is based upon the most obvious external characters.

For family discussion refer to Hennig (1960-1964), Emden (1965), and Fonseca (1968).

The genera represented in Hawaii fit into seven subfamilies. Except for treating Fanniinae as a Muscidae, I have followed the subfamily arrangement of Pont, *in* Delfinado and Hardy (1977).

KEY TO GENERA OF HAWAIIAN MUSCIDAE

1. Having a well-developed proboscis, mouthparts fitted for sucking blood, labella atrophied (figs. 124d, 125b). Arista pectinate (fig. 124d). Vein

- $M_1 + 2$ curved upward (fig. 124a). Only one or two sternopleural bristle and sternopleura densely haired. Stomoxydinae 2
 Not as above, labella usually fleshy 3
- 2(1). Palpi elongate, almost as long as the proboscis (fig. 124d). Two sternopleural bristles. Mesonotum not vittate **Haematobia irritans** (Linnaeus).
 Palpi comparatively small, about one fourth to one third as long as proboscis (fig. 125b). One sternopleural bristle. Mesonotum distinctly gray vittate **Stomoxys calcitrans** (Linnaeus).
- 3(1). Vein $M_1 + 2$ strongly curved upward before apex, the upcurved portion forming nearly a straight line and greatly narrowing cell R_5 at apex and with $M_1 + 2$ ending before or at wing apex (fig. 28a) 4
 $M_1 + 2$ straight or only gently upcurved apically and ending well beyond wing tip (figs. 15a, 24a) 7
- 4(3). Pteropleura bare 5
 Pteropleura setose. Muscinae, Muscini 6
- 5(4). Arista short, pubescent. Beret bare. Anterior sternopleural bristle present. Palpi and antennae rufous. Two postsutural intraalar bristles present
 Muscinae, Hydrotaeini
 **Synthesiomyia nudiseta** (Wulp).
 Arista and beret long haired. Anterior sternopleural absent. Antennae and palpi mostly or entirely dark colored. Only one postsutural intraalar. Mydaeinae
 **Graphomya occidentalis** Arntfield.
- 6(4). Metallic blue, calliphorid-like flies
 **Orthellia viridis** (Wiedemann).
 Mostly gray flies with dull black vittae on mesonotum **Musca** Linnaeus.
- 7(3). Hind tibiae lacking a dorsal bristle near middle and mid tibia not with a posterior and an anterodorsal bristle at apical $2/3 - 3/4$. Second anal vein straight or nearly so, not curved strongly upward. If with only two sternopleurals the entire body is polished black 8
 Only two sternopleural bristles. Hind tibiae with a strong dorsal bristle just beyond middle in line

- with preapical dorsal bristle. Mid tibia with a posterior and an anterodorsal bristle near apical 2/3-3/4. Second anal vein strongly curved upward so that it would bisect $Cu_1 + 1st\ A$ if it were extended to wing tip (fig. 11a). Fanniinae 14
- 8(7). *Pteropleura* bare. Palpi usually not conspicuously dilated 9
Pteropleura with two or more prominent setae on upper portion. Metathoracic spiracle with a clump of strong hairs on hind margin. Arista plumose on basal half. Eyes widely separated. Palpi conspicuously clavate (fig. 31f). Genitalia of both sexes as in figures 30d,h, 31a,g. Limnophorinae **Lispe** Latreille.
- 9(8). Frontal lunule small, inconspicuous, not contrasting in color from front 10
Frontal lunule prominent, densely silvery pruinose and sharply contrasting from the blue-black juncture of parafacials and parafrontals (figs. 17a, 18a). Sternopleurals 1:1. Halteres black. Thorax and abdomen shiny, blue to blue-black. Muscinae, Hydrotaeini **Ophyra** Robineau-Desvoidy.
- 10(9). Sternopleural bristles not arranged in an equilateral triangle, the lower bristle is arranged much closer to the posterior bristle (1:2), sometimes almost directly below it (fig. 27e). Labella not armed with cutting teeth. Frons of male greatly narrowed, except in *Atherigona* which lacks presutural dorsocentrals, etc. 11
Sternopleurals arranged in an equilateral triangle (1:1:1) (fig. 34c). Labella each with three strong teeth (fig. 119c). Little or no sexual dimorphism on head, eyes of male widely separated. Coenosiiinae **Lispocephala** Pokorny.
- 11(10). Arista pubescent 12
Arista long plumose (fig. 16a). Muscinae, Hydrotaeini **Muscina** Robineau-Desvoidy.
- 12(11). Vein $M_1 + 2$ straight. Mostly gray pollinose flies with brown markings on abdomen. Front femora of male not deformed and female lacking cruciate interfrontal bristles. Phaoniinae 13
 $M_1 + 2$ gently upcurved at apex (fig. 14a). Submetal-

lic black flies. Male with a preapical ventral process on front femur and female with a pair of cruciate interfrontals below ocellar triangle. Muscinae, Hydrotaeini

. **Hydrotaea houghii** Malloch.

- 13(12). Dorsocentral bristles not differentiated from mesonotal setae except posteriorly just before scutellum. Head nearly quadrate, third antennal segment elongated (fig. 25b) and antennae arising near upper margin of head (fig. 26b). Eyes of male widely separated, no apparent sexual dimorphism in head. Abdomen yellow with brown spots **Atherigona** Rondani.

Six pairs of strong dorsocentrals, two presutural. Head with front sloping, antennae near middle of head. Frons of male less than width of ocellar triangle. First abdominal sternum setose on sides. Abdomen black, gray pollinose with brown spots. **Gymnodia arcuata** Stein.

- 14(7). Crossvein r-m near apical third of cell 1st M_2 . Imaginary extension of $Cu_1 + 1st A$ and second anal veins meeting well before margin of wing (fig. 12c). First presutural dorsocentral bristles about two-thirds as long as second. Male without lower orbital bristles. Legs and palpi black **Fannia** Robineau-Desvoidy.

Crossvein r-m situated near basal two-fifths of cell 1st M_2 . Imaginary extension meeting at or near margin (fig. 11d). First presutural dorsocentral bristles weak, scarcely larger than acrostichal setae. Male with lower orbital bristles. Femora, tibiae, and palpi rufous. **Euryomma** Stein.

Subfamily FANNIINAE

Characterized by having second anal vein strongly curved forward so that if veins 2nd A and $Cu_1 + 1st A$ were extended, they would converge before the wing margin (figs. 11d, 12c). The hind tibia has a dorsal bristle beyond middle in line with the preapical dorsal bristle. Only two sternopleural bristles (1:1). The middle tibiae of the males, except in *Euryomma* Stein, have a dense covering of fine erect hairs on ventral surfaces. The females are recognized by the broad parafrontals which are convex or parallel sided on inner margins. According to Chillcott (1960:42) all other muscids have the parafrontals "narrower medianly than at the antennae or the ocellar triangle."

The larvae are very distinctive, characterized by being flattened dorsoventrally and by having very prominent, plumose, lateral projections on most of the segments. The posterior spiracles are on long stalks and consist of 3-4 lobes with an opening at distal end of each lobe.

Two genera are known from Hawaii. These are differentiated by the characters given in the key to genera of Hawaiian Muscidae.

For a revision of the Nearctic Fanniinae refer to Chillcott (1960). Pont, in Delfinado and Hardy (1977), has raised Fanniinae to family ranking.

Genus **EURYOMMA** Stein

Euryomma Stein, 1899, Ent. Nachr. 25:19. Type-species, *hispaniense* Stein, by original designation, = *peregrinum* (Meigen).

The generic characters are as given by Chillcott (1960:224). "Head with oral margin not protruding, male with two orbital bristles (no head dimorphism), arista short to long pubescent. Thorax with a weak anterior and a strong posterior presutural dorsocentral; two strong sternopleurals with occasionally a median bristle-like setula. Wing with second anal vein weakly curved forward so as to intersect an extension of the first anal vein at or just before the margin of the wing (fig. 11d), costal spine not developed. Abdomen broadest before posterior margin of second segment, that segment parallel-sided on apical half and not half as long as broad. Abdomen pollinose, weakly marked. Male hypopygium with no bacilliform process, aedeagus well sclerotized and elongate. Spermathecae two, spherical in shape, duct base attaching at a sharp angle."

Only one species known in Hawaii.

Euryomma peregrinum (Meigen) (figs. 11a-d)

Anthomyia peregrinum Meigen, 1826, Syst. Besch. der bekannt. europ. zweifl. Insekt. 5:187. Type-locality: Hamburg, Germany.

Hoplogaster (?) *dubia* Grimshaw, 1901, Fauna Hawaiiensis 3(1):43. Type-locality: Olan, Hawaii.

For other synonymy refer to Chillcott (1960:224).

Hawaii, Oahu. Probably on most or all of the main islands. The species has been known in Hawaii since 1895 but is rare in collections.

Immigrant. Widespread throughout much of the world.

Biology: It has been reared from compost in New Zealand by Harrison (1953).

The species is differentiated from other Fanniinae in Hawaii by having the femora, tibiae, and palpi yellow to rufous and the tarsi dark colored, brown to black; the 2nd anal vein less strongly curved upward so that the imaginary extensions of $Cu_1 + 1st A$ and 2nd A would meet near the wing margin (fig. 11d). The bristling of the hind tibiae (fig. 11c) and other chaetotaxic features of the legs are distinctive, as are the genitalia. It should be noted that this may resem-

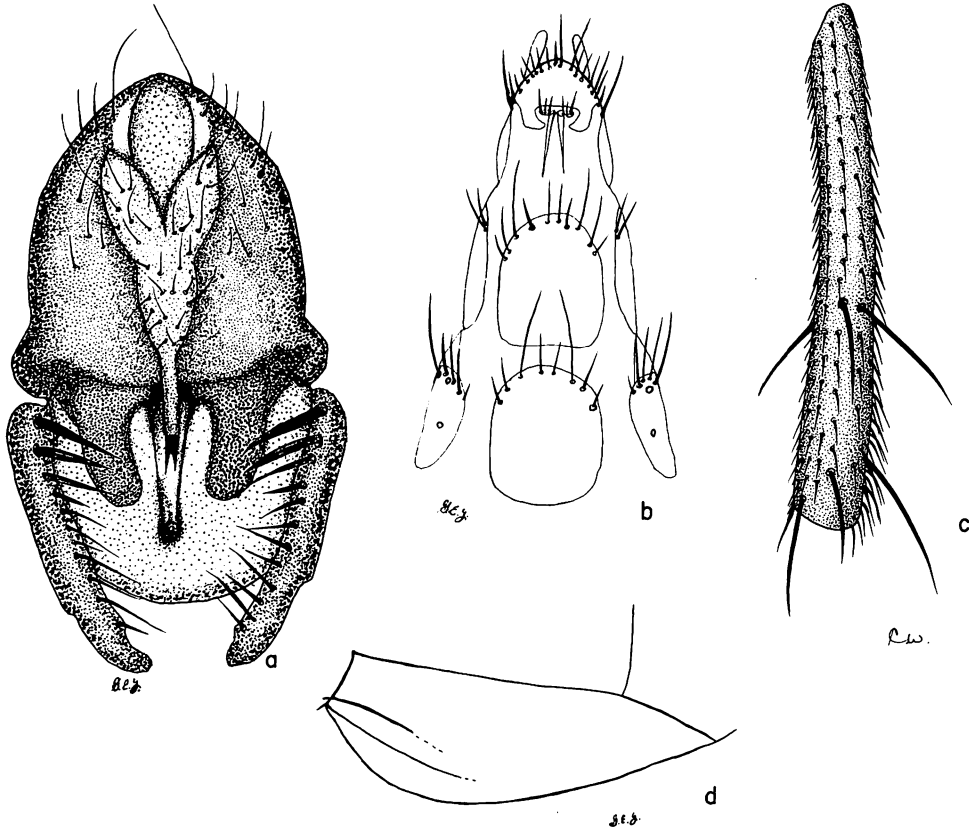


Figure 11—*Euryomma peregrinum* (Meigen): a, male genitalia, ventral; b, female, apex of abdomen, ventral; c, hind tibia, dorsal; d, hind portion of wing.

ble a small *Lispocephala* until the arrangement of the sternopleural bristles, second anal vein, genitalia, and so on, are checked.

First two antennal segments yellow, third black, about one-half longer than wide. Arista pubescent. Thorax gray pollinose with faint indications of three, longitudinal brown vittae. Scutellum yellowish around apex and on venter. First presutural dorsocentral bristles weak, about one-third as long as second presuturals. Sternopleuron with two strong bristles and one prominent (median) seta. Wings hyaline, veins yellowish. Crossvein r-m situated near basal two-fifths of cell 1st M_2 , anal veins as in figure 11a. Legs yellow except for black tarsi. Front tibia with a small but distinct anterodorsal bristle near apical fourth of segment. Hind tibia with a pair of anterodorsal bristles aligned with the dorsal bristles (fig. 11c). Abdomen mostly brown to brownish yellow in ground color, yellowish at apices of terga and covered with yellow-brown pollen. Genitalia of both sexes as in figures 11a, b.

For further descriptive details refer to Chillcott (1960:224).

Genus **FANNIA** Robineau-Desvoidy

Fannia Robineau-Desvoidy, 1830, Essai sur les Myodaires 2:567. Type-species, *saltatrix* Robineau-Desvoidy, by monotypy, = *scalaris* (Fabricius). For synonymy refer to Chillcott (1960:43).

Differing from *Euryomma* Stein by having vein 2nd A strongly bowed and curved upward so that the imaginary extensions of Cu_1 + 1st A and 2nd A would meet well before wing margin and the r-m crossvein is situated near apical third of cell 1st M_2 in Hawaiian species. Both presutural dorsocentrals are strong, with the first pair nearly two-thirds as long as second pair. Also, the body and legs are black, the leg bristling differs as do the genitalic characters.

Bionomics: According to Lyneborg (1970a:1) "*Fannia* larvae are saprophagous and are commonly found in a great variety of habitats including fungi, decaying plant material and animal matter including excrement." *Fannia benjamini* Malloch adults, in California, have been observed feeding on blood of cattle at biting wounds made by tabanids (Garcia and Radovsky 1962).

For a monograph of the Nearctic species refer to Chillcott (1960) and for larval taxonomy of European species refer to Lyneborg (1970a).

Two species have been recorded from Hawaii.

***Fannia canicularis* (Linnaeus)** (figs. 12a-d)

Musca canicularis Linnaeus, 1761, Fauna Suecica, Ed., II:454. Unjustified new name for *lateralis* Linnaeus. Type-locality: Europe.

For synonymy refer to Chillcott (1960:188) and to Hockett, in Stone et al. (1965:894).

Widespread on all Hawaiian islands. First recorded in Hawaii in 1901 by Howard (1901:490), as *Homalomyia* Bouché.

Immigrant. Cosmopolitan. Chillcott (1960:190) says this species is almost as widespread over the world as *Musca domestica* Linnaeus and is commonly referred to as the "lesser" or "little house fly."

Biology: Breeds commonly in all kinds of decaying organic matter and in fungi. Many reports are in the literature of this species causing intestinal and urogenital myiasis and there have been rare reports of wound and aural myiasis (James 1947:130). For a detailed account of pathogenesis involving this species refer to Zumpt (1965:44). For descriptions of the immature stages, refer to Hewitt (1912:162); Zumpt (*loc. cit.*); and Lyneborg (1970a:19). We have no records of myiasis in Hawaii. Zimmerman (1944) reported finding larvae of *Fannia* sp. in the ear of a cow. The ears were heavily infested with larvae of *Chrysomya megacephala* (Fab.) and *C. rufifacies* (Macq.), and the *Fannia* were probably secondary invaders.

This species is easily differentiated from the other known Hawaiian species in this genus, *pusio* (Wiedemann), by its larger size, body averaging 7.0-7.5 mm. rather than 4.0-4.5 mm.; the male abdomen with terga 2 and 3 predomi-

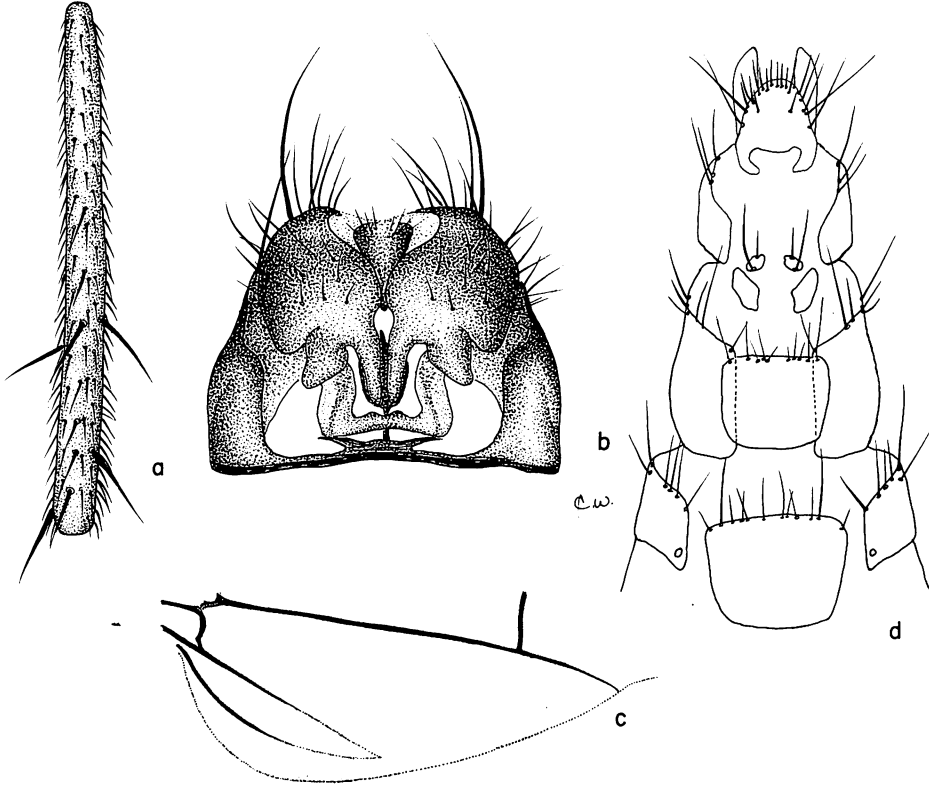


Figure 12—*Fannia canicularis* (Linnaeus): a, hind tibia; b, male genitalia, end view; c, posterior portion of wing; d, female abdomen, ventral (from Chillcott 1960:276).

nantly covered by large yellow anterolateral spots and tergum 5 with a yellow basal spot on each side; the median vittae somewhat triangulated; upper fronto-orbital bristles well developed in both sexes, extending almost to the ocellar triangle; also the bristling of the legs is distinctive (fig. 12a) as are the male genital characters (fig. 12b).

Predominantly black flies except for the yellow bases of tibiae and yellow side markings on abdomen, rather densely gray pollinose with three indistinct brown vittae extending longitudinally down mesonotum. The face and front are densely silvery gray pubescent. Hind femora and tibiae lack long ventral hairs. Hind tibia with two anteroventral bristles near apical third of segment with one anterodorsal bristle about opposite the second dorsal and with several erect bristle-like setae along anterodorsal line. Posterior portion of wing as in figure 12c. Surstyli bilobed. The female is predominantly black in ground color or rather densely grayish pollinose, with no indication of yellow markings on abdomen in the specimens on hand. In direct light the pollen over the body has a faintly blue-gray sheen. Median portion of female front mostly brown with

some gray pollen extending in from the parafrontals. Parafrontals and face silvery gray. Female abdomen as in figure 12d.

***Fannia pusio* (Wiedemann) (figs. 13a-d)**

Anthomyia pusio Wiedemann, 1830, Aussereurop. Zweifl. Insekt. 2:437.

Type-locality: South America.

Fannia pusio (Wiedemann), Malloch, 1913, Proc. U. S. Nat. Mus. 44:623.

Homalomyia femorata Loew, 1861, Wien. Ent. Monatsch. 5:42. Type-locality: Cuba.

Widespread over all the Hawaiian islands. First recorded by Grimshaw (1902:84) as *Homalomyia femorata* Loew, collected "on the Honolulu Mts. in 1900." It was reported as *Fannia* (*Homalomyia*) *pusio* (Wiedemann) by Illingworth (1917:271); its life history was also discussed.

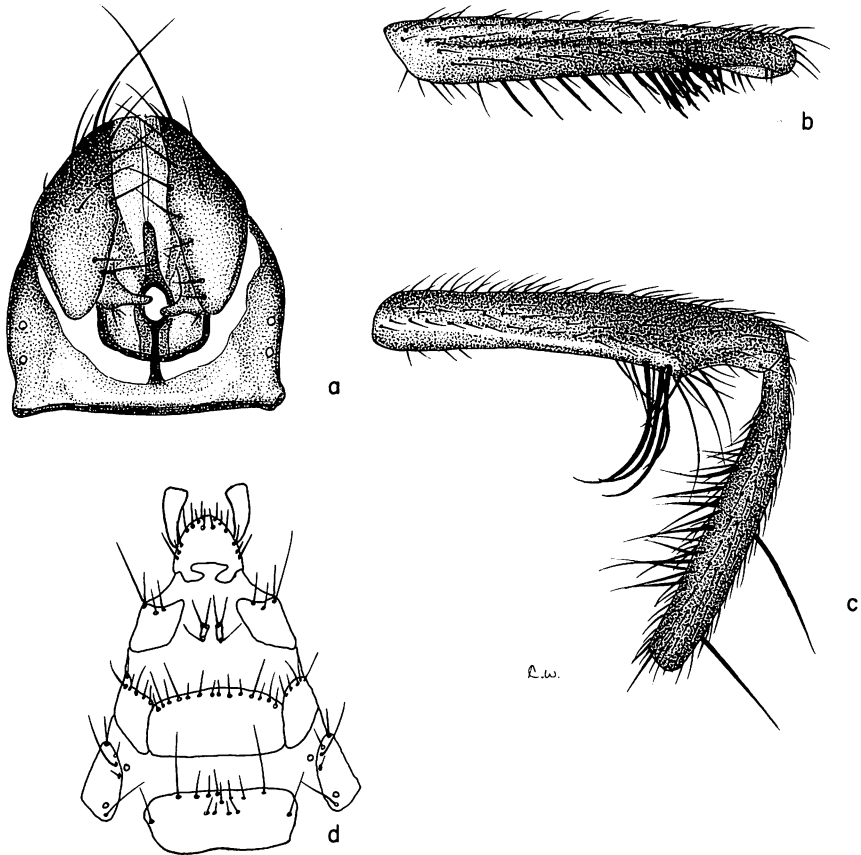


Figure 13—*Fannia pusio* (Wiedemann): a, male genitalia, end view; b, middle femur of male; c, hind femur of male; d, female abdomen, ventral (from Chillcott 1960:278).

Immigrant. Widespread over the new world, especially southern U.S. over South America; also southern Mariana Islands, Wake Island, Ocean Island, and Samoa.

Biology: Breeds in all sorts of decaying organic matter.

Small subglossy flies ranging in size from 3.5 to 4.75 mm. for the body length. Readily differentiated from *canicularis* by having the male abdomen black in ground color, predominantly gray pollinose with a black, median, straight-sided vittae and with prominent dull brown spots on sides of terga 3-4. Also, the middle femora of male each with a dense clump of preapical, short, black, ventral spines (figs. 13b). Hind femur with a dense clump of preapical, ventral, long hairs and hind tibia with long ventral hairs (figs. 13c). The upper orbital bristles are lacking in the male. Hind tibiae with no prominent bristles other than the two dorsals. The mesonotum is not vittate. Male genitalia as in figure 13a. In the female the abdomen is subshiny black, lacking vittae or maculations; the ventral aspects are as in figure 13d.

Subfamily MUSCINAE

As presently comprised, following Hennig (1965:23), this is a heterogeneous group of genera characterized by having the female ovipositor elongate, tube-like. With both the tergum and sternum of the eighth segment divided into two long, slender, rod-shaped sclerites (fig. 14c), the cerci sclerotized and protruding well beyond ninth sternum (hypoproct), and proclinate superior fronto-orbital bristles usually present in females. Hennig separates this from Phaoniinae by the presence of the slender sclerites (struts) in eighth sternum; these are lacking in Phaoniinae. In half of the genera occurring in Hawaii the apical portion of vein $M_1 + 2$ is strongly bent upward so that the vein ends before wing apex (fig. 19a). It is gently upcurved in *Hydrotaea* Robineau-Desvoidy (fig. 14a) and *Muscina* Robineau-Desvoidy, and is straight in *Ophyra* Robineau-Desvoidy; eyes of male rather close together on front, except in *Orthellia* Robineau-Desvoidy; arista plumose, except in *Synthesiomyia* Brauer and Bergenstamm and *Ophyra*; five or six lateral scutellars, except in *Musca* Linnaeus and *Ophyra*; three humerals, except in *Ophyra aenescens* (Wiedemann); sternopleurals 1:2 or 1:1 in *Ophyra* and *Hydrotaea*, and lower calypter usually truncate apically, with inner margin close to scutellum.

According to the Hennig classification the genera present in Hawaii fit into two Tribes.

Tribe HYDROTAEINI

The only obvious character which I see for grouping these is that the pteropleura are bare, or pubescent in *Ophyra*, not setose.

According to Pont (1973) the larvae of Hydrotaeini are carnivorous.

Four genera fit here: *Hydrotaea* Robineau-Desvoidy, *Muscina* Robineau-Desvoidy, *Ophyra* Robineau-Desvoidy, and *Synthesiomyia* Brauer and Bergenstamm.

Genus **HYDROTAEA** Robineau-Desvoidy

Hydrotaea Robineau-Desvoidy, 1830, Acad. Roy. des Sci. Mém. Prés. par divers Savans [Ser. 2], 2:509. Type-species, *Musca meteorica* Linnaeus, by subsequent designation (Curtis 1839, pl. 768).

For synonymy refer to Hockett, in Stone et al. (1965:899).

Differentiated from other Muscinae, which have the arista pubescent, by having front femora of male with a concavity on preapical ventral surface and with one or two prong-like processes or marginal callosities on sides of the depression (fig. 14b). The front legs of both sexes are usually held in a raptorial position, with the coxae extending anteriorly rather than posteriorly. Eyes of male close together on front, in Hawaiian species separated by slightly more than the width of ocellar triangle. Anterior portion of each sternopleuron setose behind spiracle and notopleura bare except for upper margins. Only two strong sternopleural bristles, arranged 1:1. Arista short pubescent. Eyes about two times higher than long. The first abdominal sternum is bare and in the Hawaiian species the apical portion of vein $M_1 + 2$ is bent gently upward (fig. 14a). Females with prominent cruciate interfrontal bristles.

Only one known species in Hawaii.

Bionomics: According to Hockett, in Stone et al. (1965:899), "Adults of some species of *Hydrotaea* annoy man by feeding on his skin secretions. The larvae are commonly found in association with decaying vegetable and animal matter; some larvae feed on excrements and several species have been reared from bird's nest." According to Greenberg (1971:67) the larvae of *H. dentipes* (Fabricius) breed as scavengers during the first two instars and as predators during the third instar. *Hydrotaea* adults have been observed feeding in association with horse flies and stable flies (Tashiro and Schwardt 1953; Garcia and Radovsky 1962). The flies were seen feeding on blood from bite wounds or at times would attempt to feed simultaneously with the biting species.

For a review of the North American species refer to Hockett (1954).

Hydrotaea houghi Malloch (figs. 14a-e)

Hydrotaea houghi Malloch, 1916, Bull. Brooklyn Ent. Soc. 11:110. Type-locality: Illinois.

For synonymy refer to Hockett (1954:334).

Hawaii, Kauai, Lanai, Molokai, Maui; probably on all of the main islands. This is no doubt the species recorded by Grimshaw (1901:29) as *Hydrotaea* sp. collected on Molokai, September 1893 and on Lanai, July 1894. It was first identified as *houghi* by Malloch (Bryan 1923:290).

Immigrant. Widespread over the Nearctic Region.

Biology: No information is available concerning the biology of this species. *H. dentipes* breeds in a wide assortment of decomposing organic matter, including feces of human or domestic animals; it has also been reared from rotting meat (Hockett 1954:318). James (1947:131), in discussing the biology of

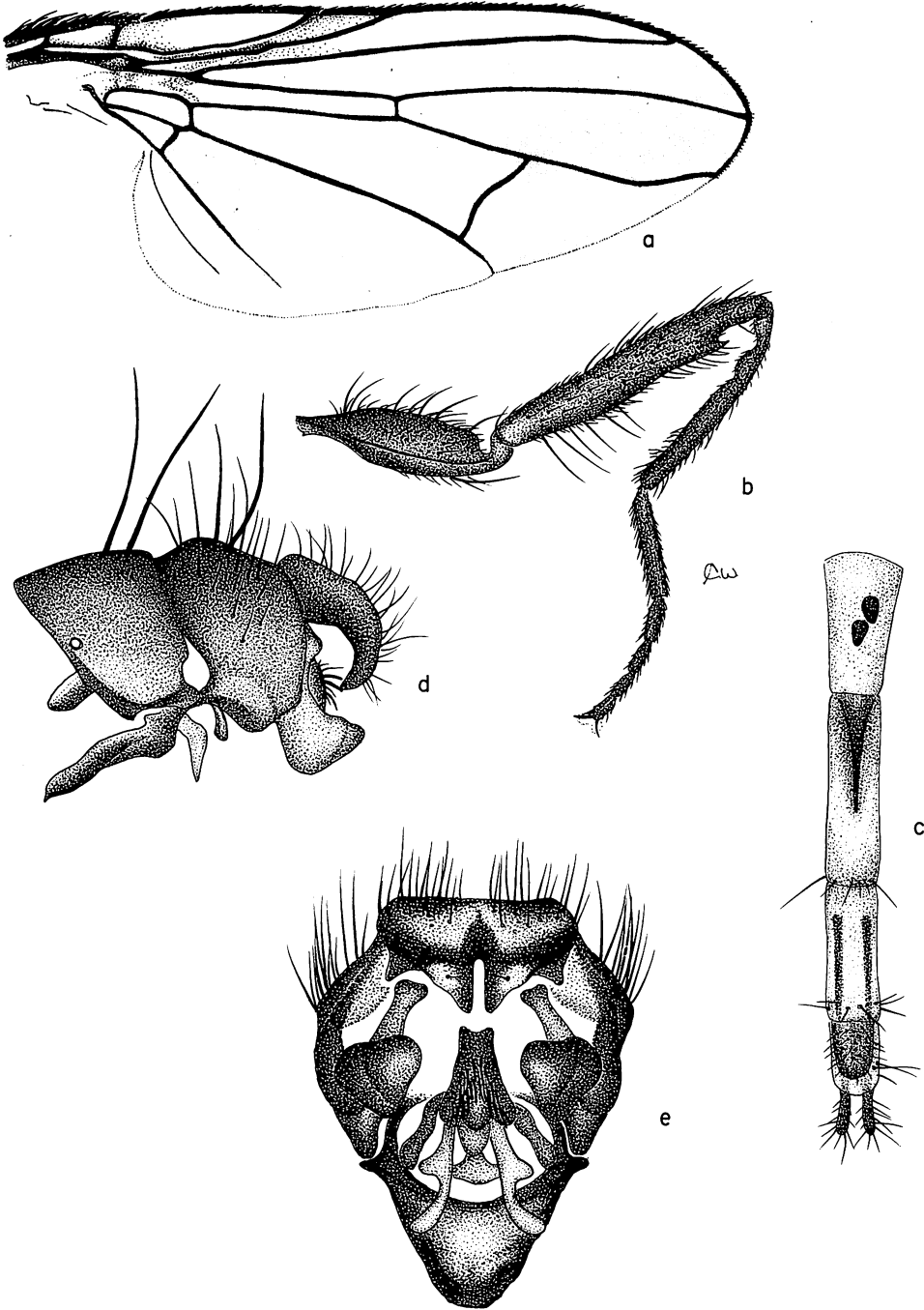


Figure 14—*Hydrotea houghi* Malloch: a, wing; b, front femur of male; c, female abdomen, ventral; d, male genitalia, lateral; e, male genitalia, end view.

Hydrotaea, says, "The larvae are at first saprophagous, although in the third stage they may become carnivorous and feed on other dipterous larvae." He also mentions that the species *meteorica* (Linnaeus) has been recorded causing intestinal myiasis and also aural myiasis. In Hawaii these flies have been attracted to traps using rotting liver as bait. The front legs appear to be adapted for grasping; these are not predaceous flies however, the labella are fitted for sponging-lapping and have no cutting teeth.

Entirely shining black flies fitting in the *dentipes* group of species by lacking ventral spines on hind femora and by having ventral processes developed near apical portion of front femur (fig. 14b). It is differentiated by having the eyes of the male separated by less than the width of the third antenna segment; middle femur with long bristles over anterior surface on basal half; vein $M_1 + 2$ gently curved upward (fig. 14a); mesonotum with distinct, pale-grayish pollen and with three faint gray vittae extending over presutural area; front tibia with a row of rather coarse, longer posteroventral setulae on apical third, these are equal in length to apical posteroventral bristle; also, front femur with a clump of short, black, ventral spinules near middle of segment and with the ventral processes shaped as in figure 14b. The females apparently fit very close to *dentipes* and, according to Hockett (1954:325), differ by having a series of longer setulae extending on the proximal half of anteroventral surface of hind femur.

This species is readily differentiated from any other Hawaiian muscids by the characters given under the generic discussion above. Because of their all shining black bodies they somewhat resemble *Ophyra* and sometimes the females may possibly be confused. They are differentiated by having the parafrontals dull gray pollinose and the entire median portion of the front predominantly opaque black; the polished ocellar triangle is comparatively short, extending only over about upper one-third of front. In *Ophyra* the parafrontals are polished and the ocellar triangle is enlarged, the polished area extends over most of the median portion of the front. Also, the gently up-curved apex of vein $M_1 + 2$ will differentiate this species from *Ophyra*.

Genitalia in both sexes as in figures 14c-e. The female has three teardrop-shaped spermathecae.

Length: body, 6.0-7.5 mm.; wings, 5.25-6.5 mm.

Genus **MUSCINA** Robineau-Desvoidy

Muscina Robineau-Desvoidy, 1830, Acad. Roy. Sci. Mém. Prés. par divers Savans [Ser. 2], 2:406. Type-species, *Musca stabulans* Fallén, by subsequent designation (Coquillett 1910:571).

Differentiated from other muscids by their robust bodies; by the plumose arista in combination with having vein $M_1 + 2$ gently curved upward apically and ending well beyond apex of wing and vein $Cu_1 + 1st A$ evanescent, not reaching wing margin; eyes of male close together on front, at narrowest point about equal in width to ocellar triangle; female with cruciate interfrontal bristles; rostrum very short, labella fleshy; hind tibiae each with a strong

posterodorsal bristle near apical third to one-fourth and the sternopleural bristles arranged 1:2 (fig. 15d). The metathoracic spiracles are two times longer than wide and have some prominent black setae along their lower margins (fig. 15c). The anterior portion of the mesopleuron behind the spiracle is bare and the notopleuron is mostly bare with setae scattered around the posterior bristle.

The Nearctic species have been treated by Snyder (1955). Two species have been recorded from Hawaii.

According to Snyder (*loc. cit.*), "The larvae of *Muscina* have been recorded as parasites or predators of other insects, as the cause of myiasis in man, or as developing in decaying organic matter."

***Muscina assimilis* (Fallén) (figs. 15a-d)**

Musca assimilis Fallén, 1823, Monogr. Muscid. Sveciae, Lund., p. 56. Type-locality: Sweden.

For synonymy refer to Hockett, *in* Stone et al. (1965:909).

Oahu, Hawaii, and Molokai. First reported in March 1953 (Hardy 1954).

Immigrant. Widespread over Europe, U.S.S.R., North and South America, Canada, Alaska to Labrador.

Biology: Probably breeds in rotting vegetation. In Hawaii it has been reared from larvae on cabbage leaves. It has, however, been reported in the literature causing fatal myiasis in nesting birds according to James (1947:137). A case of cutaneous myiasis in a child was reported by Barr and Thompson (1955) in which a larva which had been recovered from a wound on the wrist was identified as probably a third instar *Muscina assimilis*. It is possible that this species may be involved in cases of parasitism, however, it rarely enters houses and is not as closely associated with man as is *stabulans*.

Parasites: Muesebeck et al. (1951:148) reported the braconid *Aphaereta auripes* Foerster as a parasite of this species.

This species differs from *stabulans* by having the legs, palpi, antennae, basicostae, and epaulets entirely dark brown to black. Body metallic black in color. Mesonotum subiridescent, gray pollinose with four shining black vittae extending longitudinally. Vein $M_1 + 2$ gently bent upward at its apex (fig. 15a). Apex of scutellum yellow. Male genitalia as in figure 15b.

Length: body, 6.5-8.0 mm.; wings, 6.0-7.0 mm.

***Muscina stabulans* (Fallén) (figs. 16a-c)**

Musca stabulans Fallén, 1817, K. Vetensk. Akad. Handl. [Ser. 3], 1816:252.

Type-locality: Sweden.

Oahu. First collected June 13, 1948 (Joyce 1949).

Immigrant. Widespread over the Palearctic, Ethiopian, Nearctic, and Oriental regions. Van Emden (1965:217) has also recorded it from Fiji.

Biology and habits: This species occurs commonly in houses as well as in stables and is sometimes called the non-biting stable fly. It breeds in all kinds

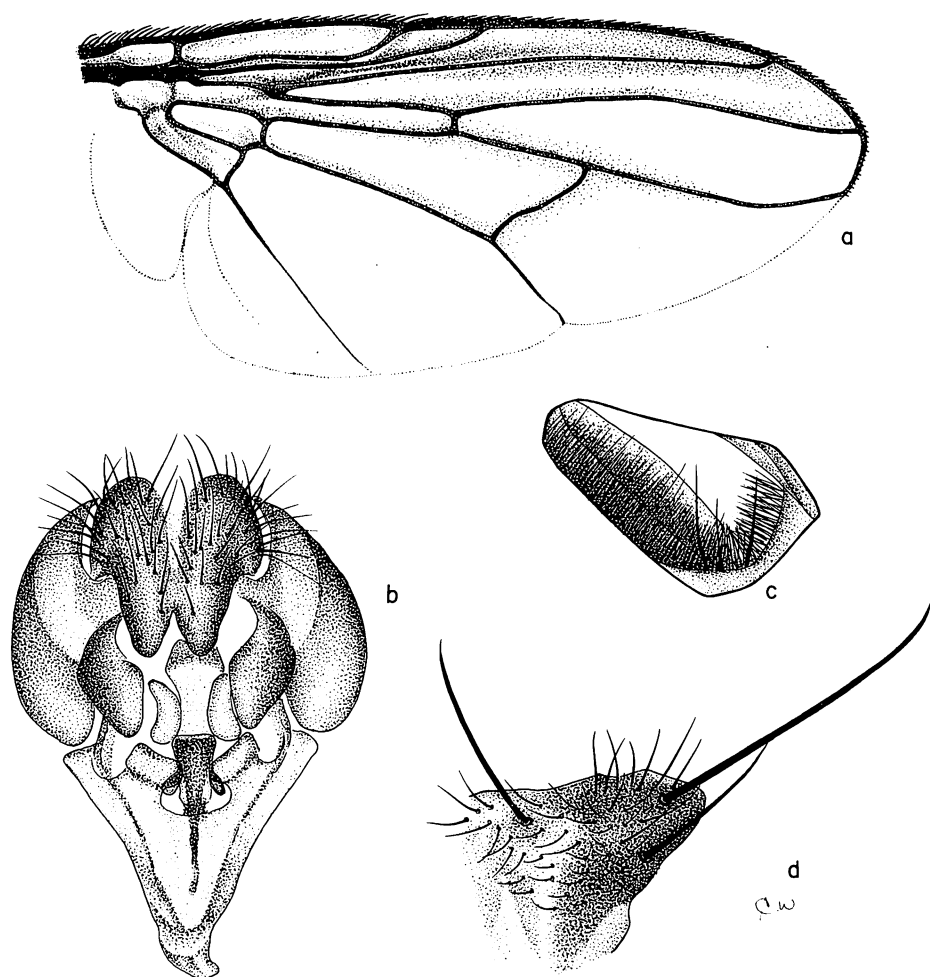


Figure 15—*Muscina assimilis* (Fallén): a, wing; b, male genitalia, end view; c, metathoracic spiracle; d, bristles on sternopleuron.

of decomposing organic matter and is reputed to cause wound and intestinal myiasis in vertebrates. According to James (1947:137), Zumpt (1965:38), and other authors, a number of cases of human intestinal myiasis have been recorded. These have apparently been cases where female flies have oviposited on foods and the eggs and larvae have been ingested and developed in the intestinal tract. This species has also been involved in a number of reported cases of traumatic myiasis in animals, also in a case of cutaneous myiasis, involving the mouth and nasal region of a monkey dying of acute tuberculosis. Nestling birds have also been reported parasitized by this fly. No cases of parasitism have been reported in Hawaii.

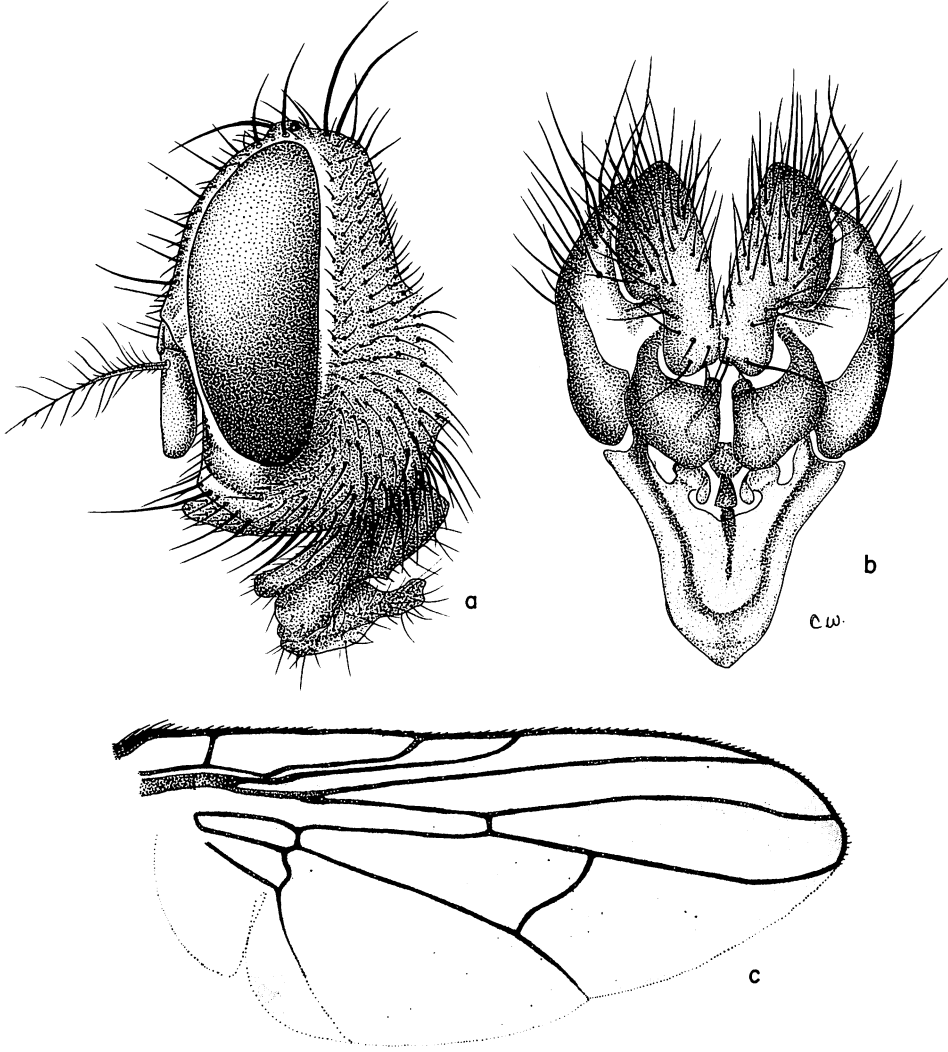


Figure 16—*Muscina stabulans* (Fallén): a, head; b, male genitalia, end view; c, wing.

The first instar larvae appear to feed mostly as scavengers and the latter instars, especially the third, are predators on larvae of other flies. Refer to Greenberg (1971:74).

Resembling the house fly in general appearance but differentiated by having vein $M_1 + 2$ gently bent upward apically and ending beyond wing apex (fig. 16c), rather than with $M_1 + 2$ strongly bent upward and ending before apex of wing.

This species is differentiated by having the palpi, tibiae, apices of femora,

the basicostae and epaulets yellow. The antennae are predominantly dark but are rufous on the base of the third segment and narrow apex of the second. The apical portion of vein $M_1 + 2$ is more strongly upcurved than in *assimilis*. The markings of the thorax and abdomen are rather similar to those of that species but the background is not so shining black. Head as in figure 16a and male genitalia as in figure 16b.

Genus **OPHYRA** Robineau-Desvoidy

Ophyra Robineau-Desvoidy, 1830, Acad. Roy. Sci., Mém. Prés. par divers Savans [Ser. 2], 2:516. Type-species, *nitida* Robineau-Desvoidy, by subsequent designation (Rondani 1866:70, 84), = *leucostoma* (Wiedemann).

Glossy, blue-black flies characterized by having the frontal lunule especially prominent and silvery-gray pubescent, contrasting from the polished blue-black juncture of parafacials and parafrontals. Front of male very narrow, at narrowest point less than two times wider than median ocellus; in the female the parafrontals are polished and the polished black ocellar triangle is elongate, in one species extending to anterior margin of front (fig. 17a) and second species extending about three-fourths the length of the front (fig. 18a). Also a prominent pair of cruciate interfrontal bristles is present, pteropleura densely pubescent. Each hind tibia with a posterodorsal bristle beyond middle and last section of vein $M_1 + 2$ is straight, not curved upward at apex. The aristaе are pubescent. Knobs of halteres dark brown to black. Sternopleural bristles 1:1. Notopleura setulose and anterior portion of each mesopleuron behind spiracle bare.

For a review of the genus *Ophyra* in the Pacific region refer to Sabrosky, (1949). According to Pont (1973) the larvae are carnivorous, living in carrion.

Ophyra aenescens (Wiedemann) (figs. 17a-c)

Anthomyia aenescens Wiedemann, 1830, Aussereurop. Zweifl. Insekt. 2:435.

Type-locality: Louisiana.

Ophyra trochanterata Malloch, 1932, Bishop Mus. Bull. 98:196. Type-locality: Marquesas.

Widespread throughout the Hawaiian islands. First reported by Grimshaw (1901:30), collected on Lanai, December 1893. This has been confused in much of the Hawaiian literature as *O. nigra* (Wiedemann) (refer to Swezey 1917, Illingworth 1923a:266, Bryan 1934:425), although most of the collections determined as "*nigra*" contained a mixture of *aenescens* and *chalcogaster*.

Immigrant. Widespread over Nearctic and Neotropical regions and Pacific islands.

Biology and habits: The larvae are general scavengers. In Hawaii this species has been reared from dead rats, rotting meat, and chicken manure (Illingworth 1923a,b,c:266, 271, 280; Sabrosky 1949:428). The adults have been observed feeding on honeydew of corn aphids.

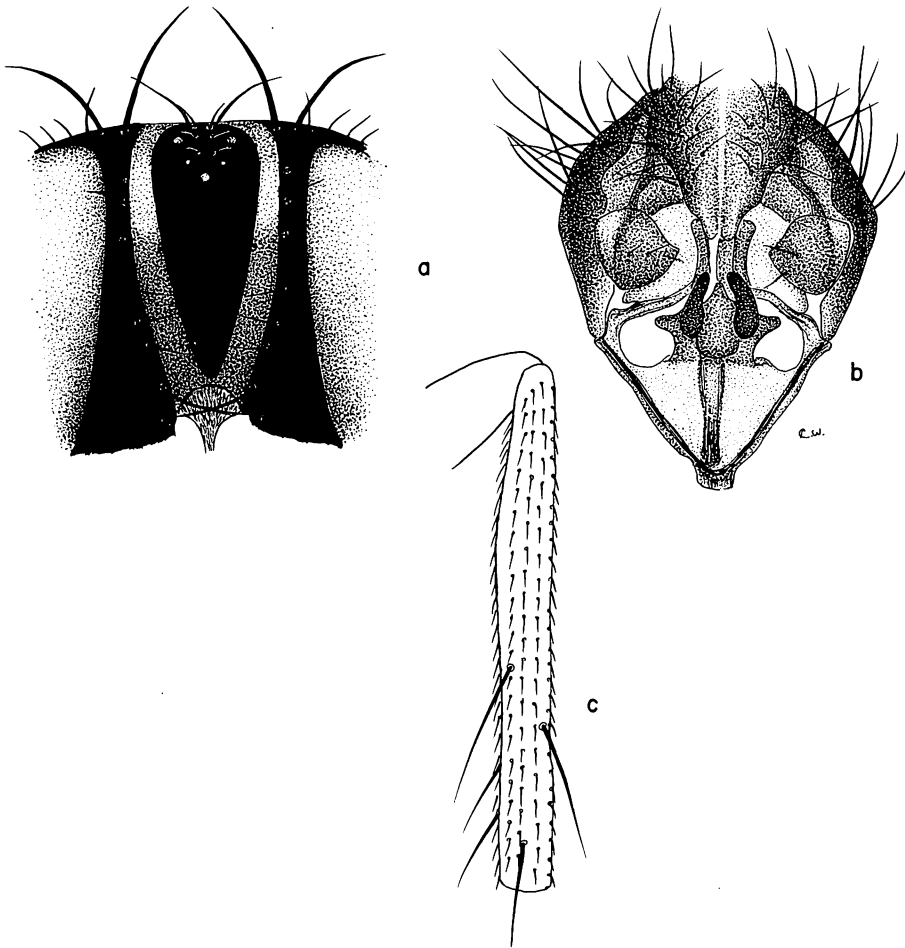


Figure 17—*Ophyra aenescens* (Wiedemann): a, front of female; b, male genitalia, end view; c, hind tibia of male, dorsal.

Differentiated by having the palpi yellow or rufous, hind tibiae of male lacking long posteroventral or anteroventral bristles or bristle-like hairs, only two humeral bristles present, and middle femora of male with stout erect ventral spines near base. The females are readily differentiated by the yellow palpi and the elongate frontal triangle which extends the whole length of the front up to the lunule (fig. 17a). Also, the posterior margin of the eye is gently emarginated and the posterior trochanter of the male has a dense clump of long hairs on the ventral surface. The middle tibiae have two posteroventral bristles in both sexes, situated beyond middle of segment. Hind tibia of male distinctly convex on dorsal margin, with one posterodorsal bristle near apical third, one antero-dorsal just beyond middle and one preapical dorsal (fig. 17c). The female has

two anteroventral bristles situated near apical one-third to one-fourth of hind tibia; the dorsal surface is not so distinctly convex as in the male. A strong posterodorsal bristle is situated near apical third but the anterodorsal bristle near middle of segment is smaller than in the male. Male genitalia as in figure 17b.

Length: body, 5.5–6.5 mm.; wings, 4.5–5.5 mm.

A rather detailed description is given by Malloch (*loc. cit.*).

Ophyra chalcogaster (Wiedemann) (figs. 18a–c)

Anthomyia chalcogaster Wiedemann, 1824, Anal. Ent., p. 52. Type-locality: Java.

Widespread over the Hawaiian islands. First recorded by Grimshaw (1901:30), collected on Oahu, April 1892; recorded also by Howard (1901) as *O. leucostoma* (Wiedemann).

Immigrant. Widespread over Ethiopian, Oriental regions, and over Pacific.

Biology: A general scavenger.

Characterized from *aenescens* by the all black palpi, having the hind margin of the eye straight as seen in lateral view and three humeral bristles present. Hind tibia of male with numerous long bristle-like anteroventral hairs over apical half of segment and with three posteroventral bristles in a row on apical third (fig. 18c). Apicoventral portions of front tarsomeres conspicuously white or yellow-white. Abdominal terga lightly pruinose with a subshining longitudinal vitta extending down middle of first three terga. Middle femur lacking ventral spines. Ocellar triangle of female extending about two-thirds to three-fourths the length of front and sharply pointed anteriorly (fig. 18a). As pointed out by Sabrosky (1949:431) the character most frequently used in the literature for separating *chalcogaster* has been the whitish apices of the front tarsomeres, especially on the ventral surface. He points out that this can be a misleading character and is not reliable for recognition of this species. Male genitalia as in figure 18b.

Length: body, 4.5–6.5 mm.; wings, 4.0–5.5 mm.

Genus **SYNTHESIOMYIA** Brauer and Bergenstamm

Synthesiomyia Brauer and Bergenstamm, 1893, K. Akad. der Wiss. Wien, Math.-Nat. Cl. Denkschr. 60:96.

Differs from other Hydrotaeini which have vein $M_1 + 2$ strongly bent upward by the short pubescent aristae (fig. 19d) and the bare beret. This is a monotypic genus.

Synthesiomyia nudiseta (van der Wulp) (figs. 19a–d)

Cyrtoneura nudiseta van der Wulp, 1883, Tijdschr. Ent. 26:42. Type-locality: Argentina.

For synonymy refer to Hockett, in Stone et al. (1965:911), and Hennig (1963:771).

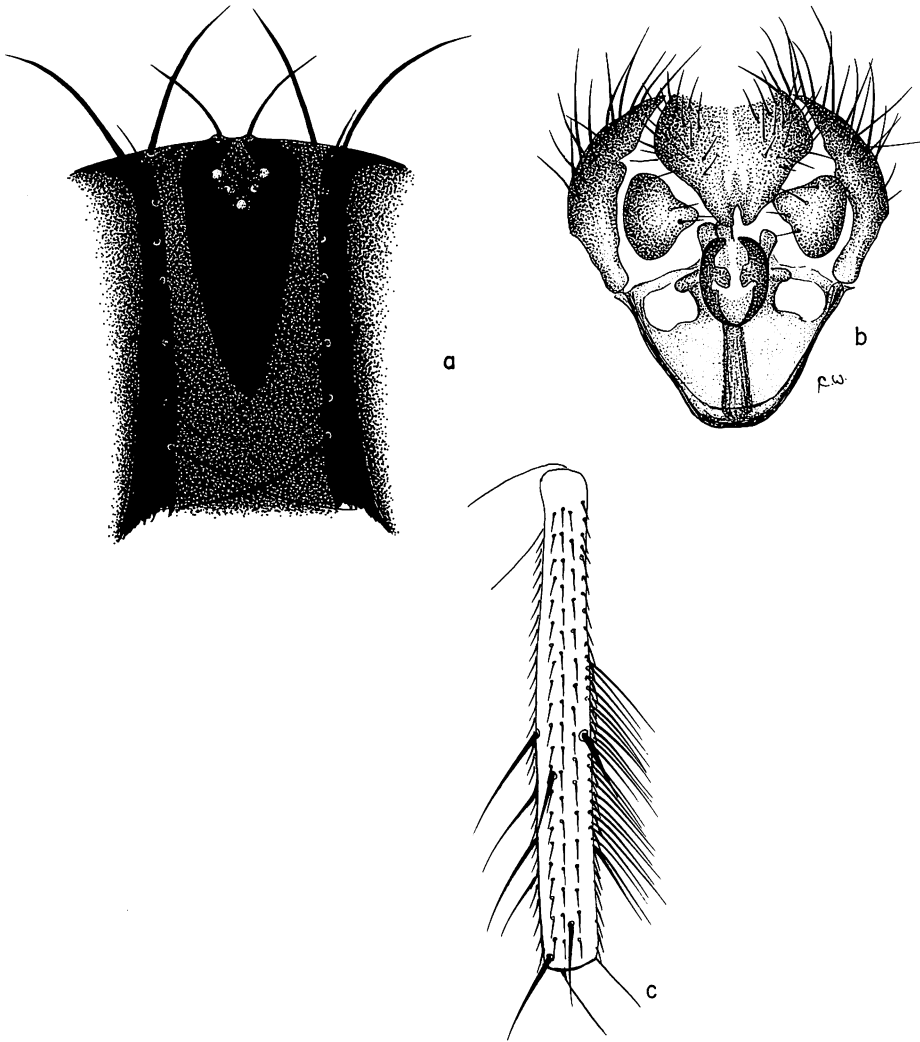


Figure 18—*Ophyra chalcogaster* (Wiedemann): a, front of female; b, male genitalia, end view; c, hind tibia of male, dorsal.

Widespread over the main islands. First recorded on Oahu in 1910 by Bridwell (1914), who referred to it as “the red-tailed *Sarcophaga*.” In some Hawaiian literature it has been referred to as *Synthesiomyia brasiliana* Brauer and Bergenstamm.

Immigrant. Tropicopolitan.

Biology: The larvae breed in a wide assortment of rotting organic matter. Bridwell (1918) gave notes on its habits in Hawaii. James (1947:124) says this species has been involved in secondary wound myiasis. Buxton and Hopkins

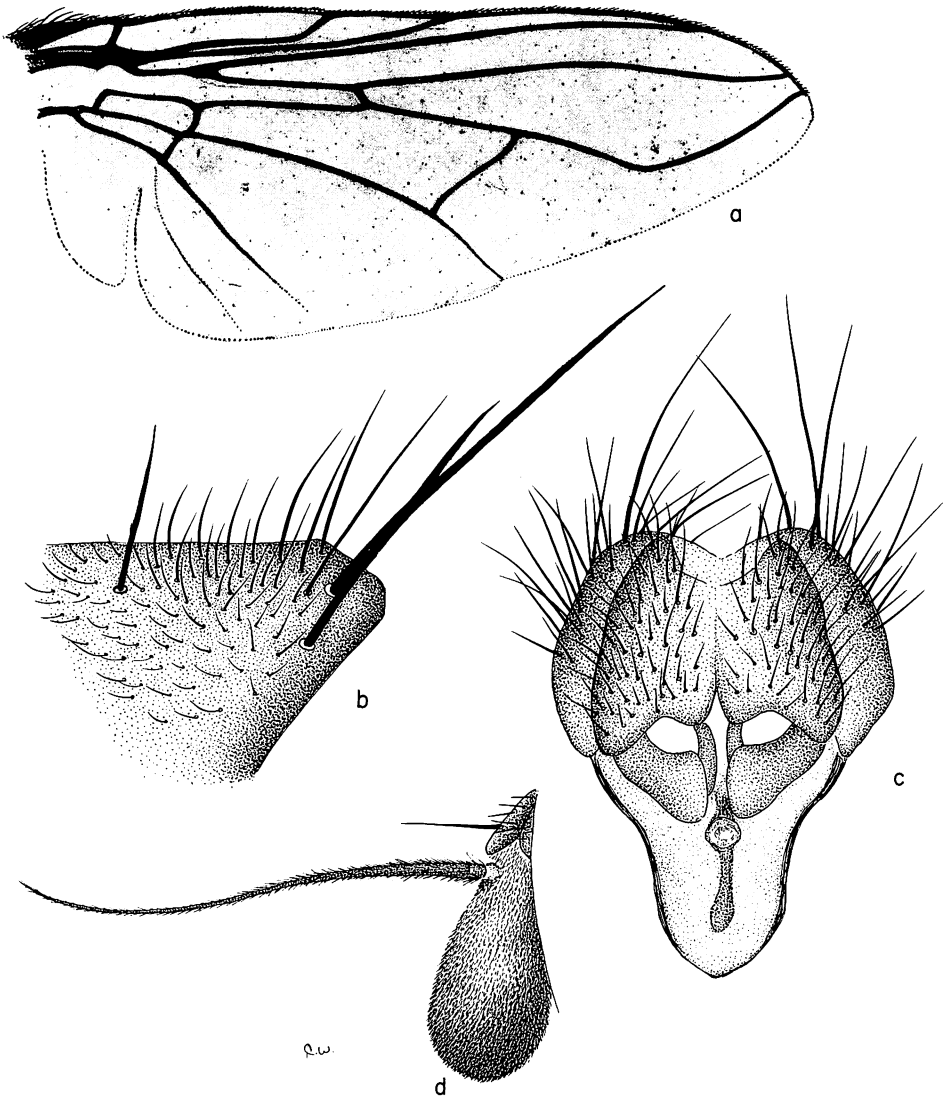


Figure 19—*Synthesiomyia nudiseta* (Wulp): a, wing; b, bristles on sternopleuron; c, male genitalia, end view; d, third antennal segment.

(1927) considered the larvae to be predaceous. The biology and description of immature stages has been given by Siddons and Roy (1942).

Predominantly gray, rather large flies, averaging 8.0–10.0 mm. for body length, and superficially resembling sarcophagids. Mesonotum gray, with four dull black vittae extending almost the entire length. Antennae and palpi yellow-rufous. Also apex of scutellum typically yellow and last abdominal seg-

ment all yellow. The bare aristae (fig. 19d) and the wing venation (fig. 19a) are distinctive. The sternopleural bristles are arranged 1:2, with the third bristle comparatively small and placed rather close to and almost beneath the upper posterior bristle (fig. 19b). Anterior portion of mesopleuron, behind spiracle, haired and notopleuron with scattered setae. Hind tibia with two each of comparatively small anterodorsal, posterodorsal, and anteroventral bristles near middle of segment. Male genitalia as in figure 19c.

For more detailed description refer to Van Emden (1965:192) and Hennig (1963:771).

Tribe MUSCINI

According to Hennig's classification (1965:32) members of this tribe are differentiated by having the pteropleura haired; by the meandering, sinuate slits on the posterior spiracles of the larvae; and by the plumose aristae.

According to Pont (1973) the larvae of Muscini, as far as is known, live in dung of various kinds, "they are important members of the dung community and no doubt exert a mildly beneficial effect in disposing of dung."

Two genera in Hawaii fit here: *Musca* Linnaeus and *Orthellia* Robineau-Desvoidy.

Genus **MUSCA** Linnaeus

Musca Linnaeus, 1758, Syst. Nat. Ed. 10, 1:589. Type-species, *domestica* Linnaeus, by subsequent designation (I.C.Z.N. 1925:1).

For synonymy refer to Hockett, in Stone et al. (1965:913), and to Shinonaga and Kano (1971:14).

Mostly gray pollinose flies with black vittae on the mesonotum and in Hawaiian species with basal abdominal segments yellowish on sides. The overall shape of the plumosity of the arista is distinctive. The rays are long compared to the arista giving the entire structure a nearly round or ovate shape (fig. 21c); suprasquamal ridge bare in Hawaiian species; basicosta yellow and anterior spiracle white to yellowish white; prosternum setulose; mid tibia without a posteroventral seta on apical half; wing membrane entirely covered with microtrichia and the forward bend of vein $M_1 + 2$ toward $R_4 + 5$ is comparatively sharp and angular. It is immediately differentiated from allied genera by lacking metallic coloration on the body.

For an excellent discussion of *Musca* refer to Pont (1973:136). For key to Oriental species refer to Van Emden (1965:43) and for keys to synanthropic species to Pont and Patterson in Greenberg (1971:11).

Only two species presently established in Hawaii. In the following key, *M. autumnalis* de Geer, the infamous "face fly" of the United States and Europe, is included since the likelihood is good that it will eventually become established here.

KEY TO MUSCA LINNAEUS

1. Propleura bare. 2
 Propleura setose **domestica** Linnaeus
 2. Mesonotum with two subshining-black longitudinal
 vittae, both sexes with the thorax densely gray
 pollinose except for the black vittae. First ab-
 dominal sternum bare. Suprasquamal ridge with
 only pubescence, no black hairs. Eyes of male
 separated by at least the width of ocellar triangle,
 at narrowest point frons equal to about 9 rows of
 eye facets **sorbens** Wiedemann
- Mesonotum with four black longitudinal vittae,
 thorax of male mostly shining black. First ster-
 num setose (fig. 20c) and basal portion of supra-
 squamal ridge with a prominent tympanic tuft of
 coarse black hairs (note, best seen by removing
 upper calypter). Eyes of male closely approx-
 imated, the frons scarcely wider than median
 ocellus and less than length of 3 eye facets.
 Hypopleura bare except for a few setae above
 hind coxae. Male genitalia as in figures 20a, b.
 U.S. mainland and Europe **autumnalis** De Geer

Musca domestica Linnaeus (figs. 21a-d)

The House Fly

Musca domestica Linnaeus, 1758, Syst. Nat. (10)1:596.

Musca vicina Macquart, 1851, Mem. Soc. Sc. Agric. Lille, 1850:226.

Musca flavinervis Thomson, 1869, in K. svenska fregatten Eugénies resa.
 Zool. Dipt. p. 547. Type-locality: Honolulu.

For other synonymy refer to Shinonaga and Kano (1971:18); Hockett,
 in Stone et al. (1965:913); Pont, in Delfinado and Hardy (1977:459).

Cosmopolitan.

Immigrant. Widespread over the islands, especially at lower elevations. The
 first record for Hawaii is that of Thomson (1869) as *flavinervis*.

The ubiquitous house fly; to the housewife and layman this is no doubt the
 best known dipteran over the entire world. In everyday English the term "fly"
 is almost synonymous with house fly. It lives in close association with man and
 domestic animals, is notoriously bothersome and, because of its eusynan-
 thropic habits, is an important contaminator of food and a potentially
 dangerous transmitter of pathogens. The literature on this species is enor-
 mous.

Bionomics: *M. domestica* has a very broad spectrum of foods but has a strong
 preference for breeding in animal manures of all kinds, although it is common-

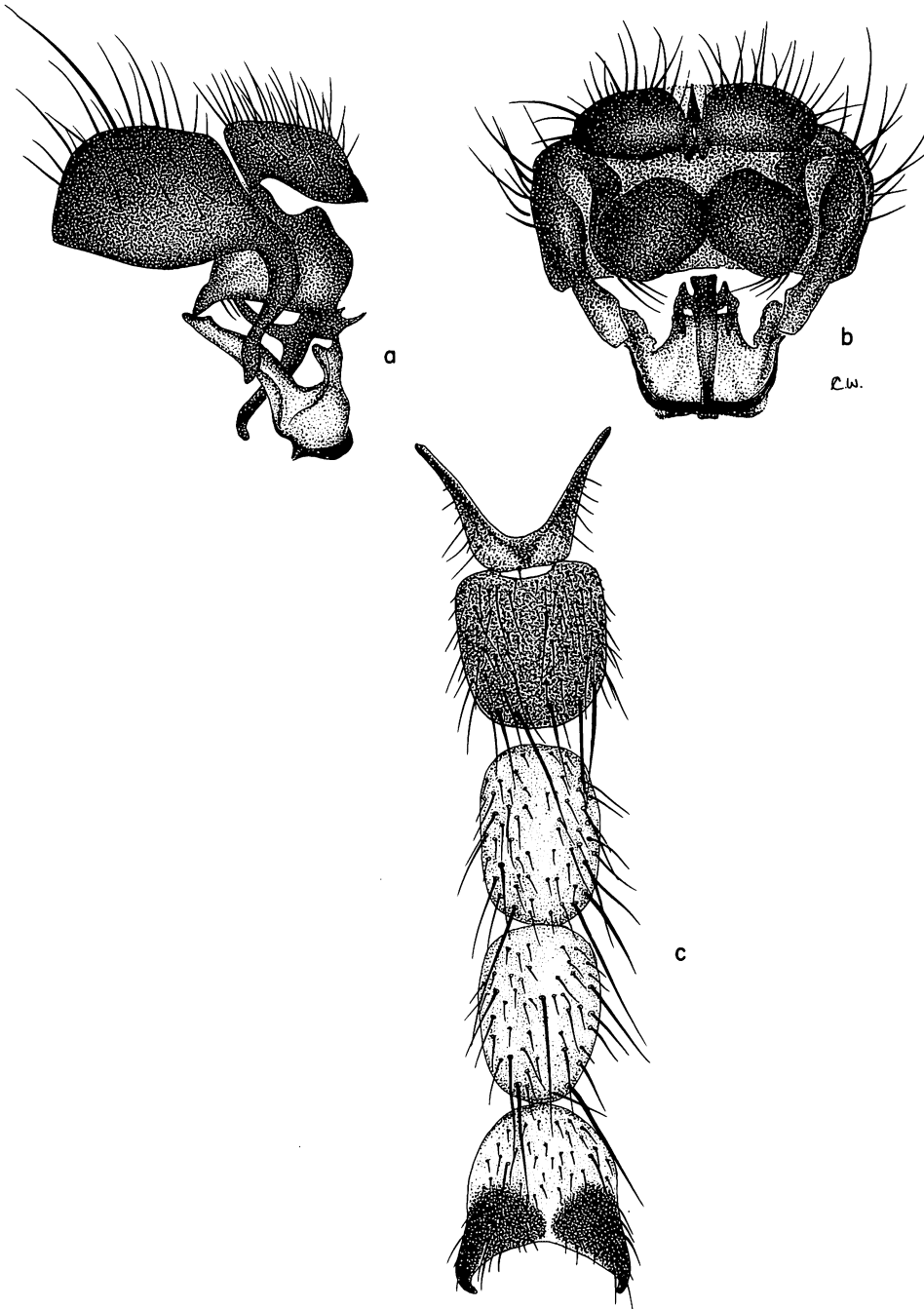


Figure 20—*Musca autumnalis* de Geer: a, male genitalia, lateral; b, male genitalia, end view; c, sterna of male.

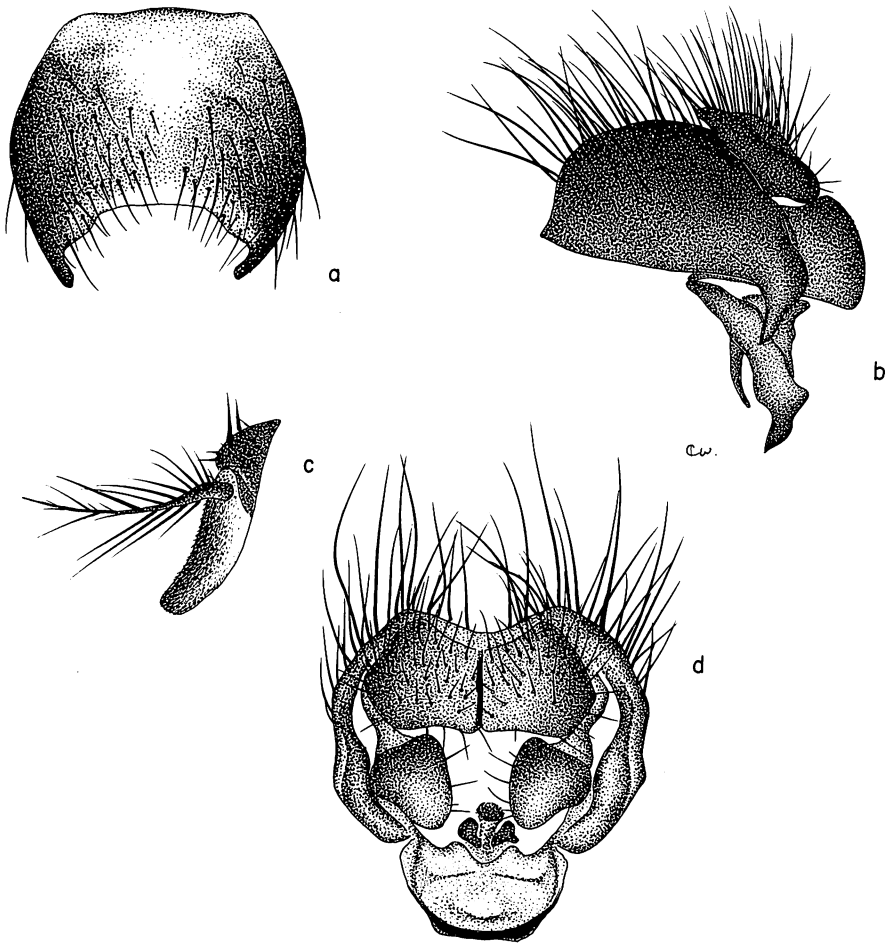


Figure 21—*Musca domestica* Linnaeus: a, fifth sternum of male; b, male genitalia, lateral; c, antenna; d, male genitalia, end view.

ly found breeding in garbage or in rotting animal or plant materials. By habits and structure the adults are ideal transmitters of a wide assortment of pathogenic organisms since they feed freely on excrement and all kinds of filth and upon human foods. According to James and Harwood (1969:261) house flies "are known to become contaminated with more than 100 species of pathogenic organisms, including the causative organisms of amebic and bacillary dysentery, typhoid fever, cholera, salmonellosis, anthrax, leprosy, yaws, trachoma, poliomyelitis, and infectious hepatitis; they can also carry certain helminth eggs, such as those of pinworm, whipworm, hookworm, *Ascaris*, and tapeworm."

M. domestica is known to be the biological host of *Habronema muscae* (Carter),

which is apparently common in horses in Hawaii (Foster and Alicata, 1939). Habronemiasis is discussed by Ross (1926), Seddon (1950), and Waddell (1969), and the part played by *Musca* in the transmission of nematodes has been reviewed by Stoffalano (1970). For a detailed account of the house fly refer to Pont (1973:168), West (1951), and for public health importance refer to James and Harwood (*loc. cit.*) and to Greenberg (1971). For information on natural enemies and biological control of house flies refer to numerous studies of E. F. Legner and colleagues (Legner 1966, 1971; Legner and McCoy 1966; Legner, Bay, and White 1966; Legner and Gerling 1967; Legner and Olton 1968, 1970).

House flies have seldom been a serious problem in Hawaii and it is probable that the bigheaded ant (*Pheidole megacephala* Fab.) is largely responsible for keeping the populations in check (Illingworth 1913; Bridwell 1918:31; and Hardy 1960:22).

In Hawaii the only fly which can be confused with *domestica* is *sorbens*. The former is readily differentiated by having four black vittae extending over the mesonotum, rather than two; and the propleura and the first abdominal sternum setose, rather than bare. Also, in the female the parafrontalia are densely gray pollinose on lower portion but subshining black above, rather than all densely gray, and the sterna and sides of abdominal terga are mostly yellowish, rather than entirely black in ground color.

The front of the male is rather broad but in Hawaiian populations varies at its narrowest point from 1 1/2 to nearly two times wider than ocellar triangle, or three to five times wider than median ocellus, or equal to length of 8-11 rows of eye facets. The Hawaiian population has been referred to in some literature as *vicina* Macquart (Bryan 1924 and Essig 1942:801). *M. vicina* has been frequently treated in the literature as a subspecies of *domestica*, characterized by the narrower front of the male. Van Emden (1965:43) gives the difference as frons of male about 2 1/2 times as wide as narrowest part of third antennal segment in *domestica* and frons up to about twice as wide as third segment in *vicina*. This character is obviously of no specific importance in this case. Pont (1973:171) states that "it is now generally recognized that the form of *domestica* with a narrow frons that occurs in warmer parts of the Old and New World is part of a geographical cline produced by the influence of climate and does not constitute a subspecies in any genetic sense."

For the characters of the male fifth sternum and genitalia refer to figures 21a, b, and d.

Length of body, 4.5-7.5 mm.

***Musca sorbens* Wiedemann (figs. 22a-c)**

Musca sorbens Wiedemann, 1830, Aussereurop. Zweifl. Insekt. 2:418.

For synonymy refer to Shinonaga and Kano (1971:22).

Widespread over the lowlands on all the main Hawaiian islands. First collected in Hawaii, September 1949 (Joyce 1950:3).

Immigrant. The distribution given in the literature refers to the *sorbens* complex of species, which, according to Pont (1973:152), occurs "in the warmer parts of the Old World, southern Palaearctic region, throughout Africa and the Malagasy subregion, throughout the Oriental and Australasian regions, and on most of the Pacific islands." *M. vetustissima* Walker is definitely recorded only from Australia but Pont says that "it is probable that many of the older records of *sorbens* and *vetustissima* from the Oriental Papuan and Pacific areas in fact refer to *vetustissima* in the present sense."

Bionomics: A notoriously pestiferous species which is strongly attracted to the body of man and which, in Hawaii, breeds predominantly in dog feces (Wilton 1963). It has become a terrible nuisance, especially in residential areas where high populations of dogs often occur. The adults are attracted to almost any part of the body where the skin is exposed and especially to bare feet and lower legs. It shows strong attraction to any body exudate, breaks in the skin,

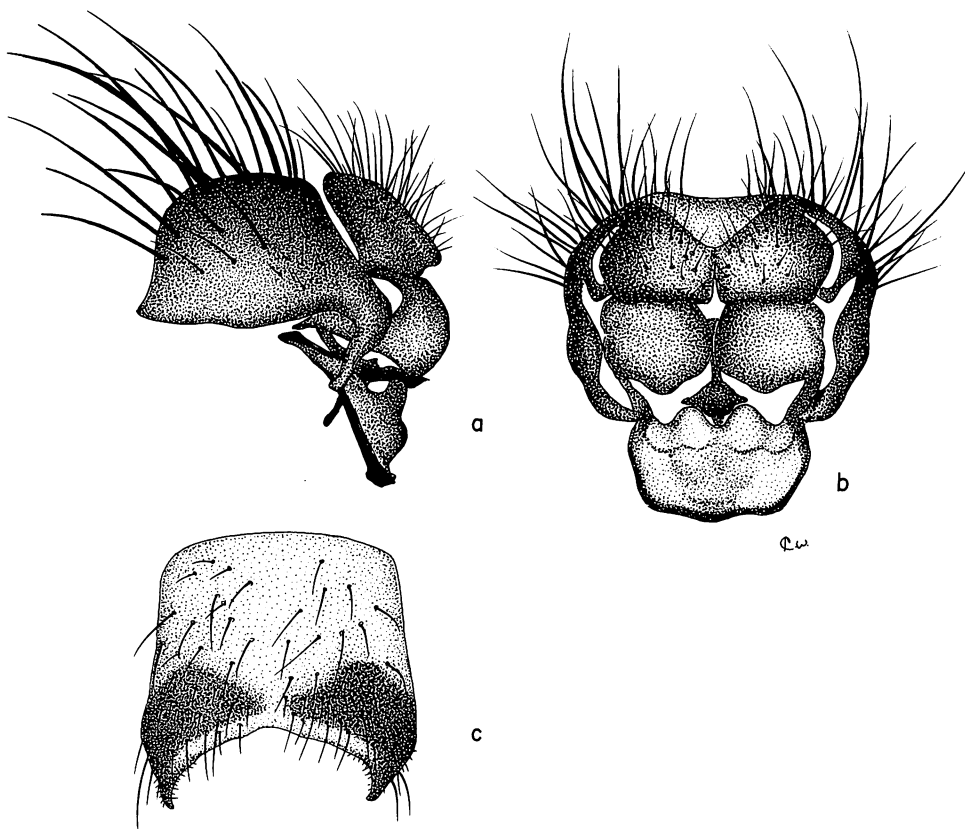


Figure 22—*Musca sorbens* Wiedemann: a, male genitalia, lateral; b, male genitalia, end view; c, fifth sternum of male.

sores, and skin lesions and is potentially (and probably) a mechanical carrier of many types of pathogens. In Hawaii there is considerable circumstantial evidence that *sorbens* may transmit beta-haemolytic streptococci in the impetigo syndrome of acute glomerulonephritis in children (Hyo-sok Yu 1971). Also, since *Salmonella* infections are known to occur commonly in dogs (Stableforth and Galloway 1959:523), *sorbens* could be a potential transmitter.

The genetic studies of Paterson and Norris (1970) demonstrated that there are three species in the *sorbens* complex, two in Africa (with *sorbens* having a wide distribution, Hawaii, etc.) and one (*vetustissima* Walker) in Australia. Pont (1973) has discussed this in his review of the Australian *Musca*, but points out that the taxonomic status of the *sorbens* complex species especially for the Oriental region is still not understood. The only satisfactory character for separating these is in the comparative width of the male frons, and, as in *domestica* vs. *vicina*, a considerable range of variation has been demonstrated within given populations; treated statistically, however, the character is significant. *M. vetustissima* is differentiated from *sorbens* by having the frons of male, at narrowest point, equal to just under one and one-half times the diameter of the anterior ocellus. The *sorbens* population in Hawaii has the male frons comparatively broad, at narrowest point equal to at least the width of the ocellar triangle, about three times wider than median ocellus, and equal to the length of about nine rows of eye facets.

In addition to the characters given in the key above, the two broad black vittae on the mesonotum are bifurcate presuturally, especially in females. The parafrontalia of the female are densely gray to about level with upper ocelli. The female abdomen is predominantly black. The fifth sternum and genitalia of the male are as in figures 22a-c.

Length of body, 4.0 mm.

Genus **ORTHELLIA** Robineau-Desvoidy

Orthellia Robineau-Desvoidy, 1863, Hist. nat. des Dipt. des environs de Paris 2:837. Type-species, *rectinervis* Robineau-Desvoidy.

For synonymy refer to Hockett, in Stone et al. (1965:912).

Metallic blue-green flies resembling Calliphoridae but lacking hypopleural bristles, and also differing by having the front metallic blue in both sexes. They are differentiated from other Muscidae which have the pteropleura setose by the brightly metallic coloration. The apical portion of vein $M_1 + 2$ is strongly bent upward (fig. 23a), and vein $R_4 + 5$ is setose on both upper and lower margins almost to the r-m crossvein. They are also characterized by having the suprasquamal ridge setose (fig. 23b) along almost entire length; mid tibia with a strong posteroventral bristle near apical third; anterior spiracle dark brown to black; metapleuron densely pilose and first sternum of abdomen setose. The lower calypter is very broad, not tapered apically, and shaped as in *Musca*.

***Orthellia viridis* (Wiedemann) (figs. 23a-h)**

Musca viridis Wiedemann, 1824, *Analecta Ent.*: 50. Type-locality: North America.

Musca caesarion Meigen, 1826, *Syst. Besch.* der bekannten Europ. Zweifl. Ins. 5:57. Type-locality: Germany.

For synonymy refer to Hockett, in Stone et al. (1965:913), Hennig (1963:931), and Pont, in Delfinado and Hardy (1977).

Found on all the main islands, associated with cattle. First reported in Hawaii by Swezey (1935) as *Cryptolucilia caesarion*, known throughout Hawaiian literature under the specific name *caesarion*.

Immigrant. Widespread over Palaearctic, Nearctic, and Oriental regions.

Biology: Breeds in animal dung and commonly associated with cattle dung

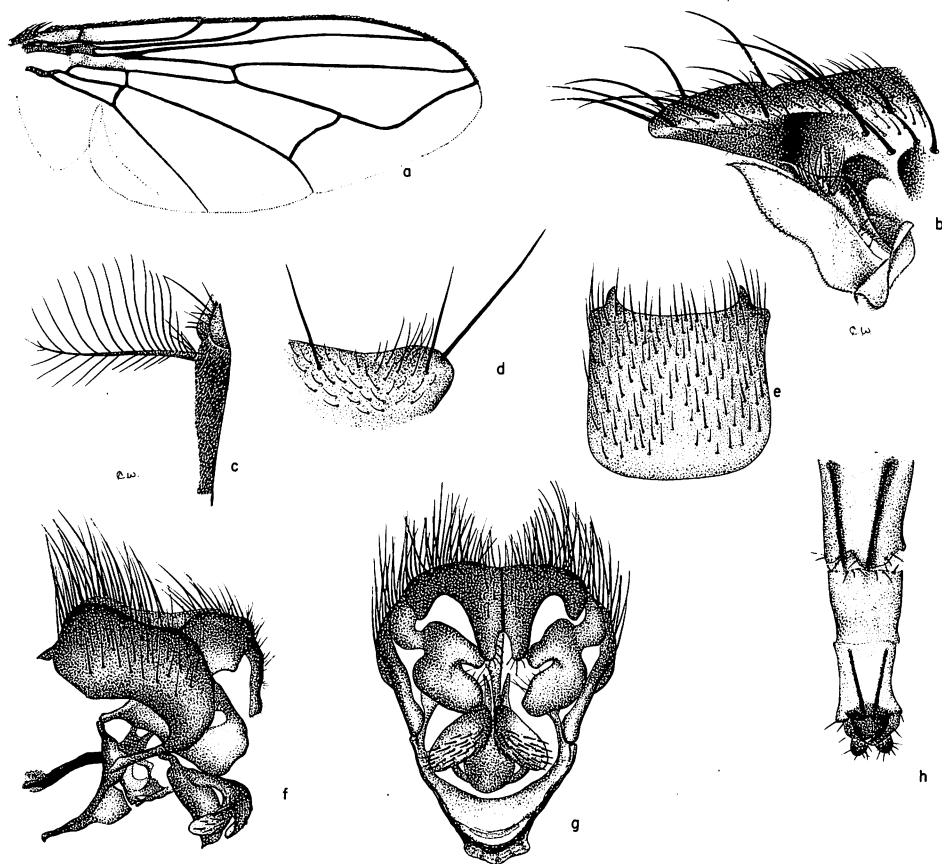


Figure 23—*Orthellia viridis* (Wiedemann): a, wing; b, posterolateral portion of thorax showing supra-squamal ridge; c, arista; d, sternopleuron; e, fifth sternum; f, male genitalia, lateral; g, male genitalia, end view; h, female ovipositor, ventral.

in Hawaii. Swezey (*loc. cit.*) said the maggots are bluish in color. The adults are attracted to fresh droppings for feeding and oviposition.

This species belongs in the group which is characterized by having two strong pairs of presutural dorsocentral bristles and with the anterior mesopleural bristle distinct. It is differentiated by having a pair of strong presutural acrostichal bristles, also by having the parafrontalia of the female metallic blue-green and distinctly broader than the interfrontalia.

The head is mostly metallic blue; the interfrontalia are opaque, dull black. The sides of the face are densely silvery pollinose and the median portion is subshining, rather lightly gray pollinose. Antennae and palpi black. Aristae plumose with the long ventral rays confined to the apical half (fig. 23c). Eyes of male rather widely separated, at narrowest point about one-half wider than ocellar triangle. Three pairs postsutural dorsocentral bristles in addition to the two pairs of presuturals. Three sternopleural bristles arranged almost in a line (fig. 23d), with the third bristle just slightly lower than the other two. Middle tibia with a strong ventral bristle near apical third and with a row of four, short anteroventral bristles on basal half. Hind tibia with a weak anterodorsal bristle near middle. Scutellum with six pairs of marginal bristles. Humeri each with three pairs of bristles. Wings densely covered with microtrichia, venation as in figure 23a, one seta present on the underside of the base of radius. Male genitalia inconspicuous, the fifth sternum and genital structures as in figures 23f,g. Female ovipositor as in figure 23h.

Length of body, 6.0–8.0 mm.

Subfamily PHAONIINAE

This grouping, as represented by the two genera present in Hawaii, does not seem logical. *Atherigona* Rondani was moved from Coenosiinae to Phaoniinae by Hennig (1965) on the basis of the development of the female ovipositor. Fitting the same grouping as Muscinae by having the female cerci sclerotized, usually long and slender, setose at least on apical portion of inner surface and protruding well beyond the ninth sternum (hypoproct). Hennig (p. 37) distinguished the Phaoniinae by having the cerci cylindrical, completely sclerotized all the way around, lying free, not adpressed against the membrane of the ovipositor, and extending well beyond ninth sternum. The latter is the case in *Atherigona* (fig. 26d), but in *Gymnodia* the cerci are rather short, are sclerotized only dorsally, and extend scarcely beyond ninth sternum (fig. 27d). In both of the genera represented in Hawaii, the eighth sternum of the female is represented only by a small sclerotized spot on each side of hind margin and the slender struts are lacking.

The Hawaiian genera fitting here have the following in common: Vein $M_1 + 2$ straight; vein Sc slightly sinuate; suprasquamal ridge and pteropleura bare; sternopleural bristles arranged 1:2, and the arista pubescent.

The two genera present represent two different tribes and are differentiated by the characters given in the generic key above.

Tribe ATHERIGONINI

Genus **ATHERIGONA** Rondani

Atherigona Rondani, 1856, Dipt. Ital. Prodr. 1:96. Type-species, *Coenosia varia* Meigen, by original designation.

Differentiated by having the presutural dorsocentrals weak, scarcely larger than the mesonotal setae; head nearly quadrate with bases of antennae arising near upper margin of head and arista at about upper one-fourth to one-third of eye (fig. 26b); eyes of male widely separated on front; costa slightly convex between humeral crossvein and apex of Sc and Sc ending about opposite r-m crossvein; first abdominal sternum and prosternum bare; only one pair of reclinate fronto-orbital bristles present; hind tibia with a posterodorsal bristle at middle and posteroventral bristles of front femur confined to apical third of segment.

For taxonomic studies of *Atherigona* refer to Van Emden (1940:97-143), Hennig (1961:493-504), Snyder (1965:239-260), and Pont (1972). For a detailed study of the male abdomen refer to Venturi (1968).

The species are grouped into two subgenera, *Atherigona* Rondani and *Acritochaeta* Grimshaw. These are differentiated by the following characters.

KEY TO SUBGENERA AND SPECIES IN HAWAII

1. Crossvein r-m situated at or beyond middle of cell 1st M_2 . Palpi rufous, tinged brown to black especially on apices. Interfrontal area rufous or reddish brown on upper portion. Basal scutellars bristle-like, over two times stronger than acrostichal setae and about half as long as subbasal, lateral, scutellar bristles. Disc of scutellum with 20 or more setae. Six to 8 rows of acrostichals immediately behind suture. Male with front femur constricted dorsally before apex and with a dense patch of anterodorsal setulae at apex (fig. 26f). Lacking a dorsal protuberance on sixth tergum or a trifoliate process on the genitalia. **Acritochaeta** . . . 2
- Crossvein r-m situated distinctly before middle of cell 1st M_2 (fig. 24a). Palpi entirely yellow, shaped as in figure 24c. Interfrontal area velvety black on upper half, yellow below. Basal scutellars seta-like, about equal in size to acrostichals and scarcely one-fourth as long as subbasal bristles. Disc of scutellum with only 6-10 setae. Only 4 rows of acrostichals immediately in front

of suture. Front femora of male normal. Sixth tergum of male with a dorsal, indistinctly trilobed, protuberance (fig. 24d). Cercal plates bearing a trifoliate process (fig. 24e). **Atherigona** **reversura** Villeneuve.

2. Apex of wing brown (in some cases this may be faint or, in teneral specimens, may not be discernible). Mesonotum with three prominent, brown vittae; disc of scutellum mostly brown. Interfrontal area largely dark brown to black. Prosternum rufous, tinged with brown posteriorly. Legs of male all yellow and male palpus straight, densely long yellow pilose on underside at apex (fig. 25e) **hendersoni** Malloch.

Wings entirely hyaline. Mesonotum and scutellum gray pollinose with only indistinct vittae on former. Interfrontal area mostly orange to rufous. Prosternum polished black or reddish black. All tarsi, front tibia, and apex of front femur of male brown to blackish, and male palpus gently curved, with short, fine yellow pile on apical half ventrally **orientalis** Schiner.

Subgenus **ATHERIGONA** Rondani

Differentiated from *Acritochaeta* Grimshaw by the secondary sexual characters noted in the key above. The most distinctive group characters are the normal front femora of male, the development of a strong protuberance on the sixth tergum, and a very prominent trifoliate process arising from the cercal plates (fig. 24d). As pointed out by Ramachandra Rao (1924) and Deeming (1971), this is used in courtship.

According to Pont (1972:31), "All *Atherigona* breed, so far as is known, in grasses but strictly speaking are not phytophagous. The young maggot bores through the stem of the grass into the central shoot, and then feeds on the decaying core of the shoot. It does not feed on the living plant tissue, and in fact it dies if it cannot sever the central shoot (Ponnaiya, 1951)." These are the "shoot flies." Numerous species have been recorded over much of the world, especially the tropics and subtropics. They have been recorded breeding in many species of grasses and some are pests of cereal crops such as sorghum, rice, millet, corn, wheat, and also of sugar cane (in Japan). (Ref. Van Emden 1940; Pont 1972; Pradhan 1971; Deeming 1971; and Shibuya and Tanaka 1969.) For notes on the mating behavior refer to Deeming (1971:148-149) and to Ramachandra Rao (1924). Pont (1972:31) treats *Atherigona* as the sole representative of the tribe Atherigonini.

Only one species is known in Hawaii.

***Atherigona (Atherigona) reversura* Villeneuve (figs. 24a-f)**

Atherigona reversura Villeneuve, 1936, Ark. Zool. 27 A(36):11.

Oahu. First reported May 1974 (Hardy, D. E., 1976), collected in light traps January 1974. Widespread over Oahu, Maui, and Kauai.

Immigrant. Widespread throughout the Oriental region, also China and Japan.

Host plant: Bermuda grass, *Cynodon dactylon* (L.).

Biology: The young maggots bore through the grass stems and feed on the decaying cores of the shoots. Heavy infestations cause severe damage to bermuda grass.

Pont (in correspondence) has pointed out that *reversura* is most closely related to *laeta* Wiedemann, from the Oriental region, and to *matema* Curran, from the Papuan subregion.

It is characterized by having the interfrontal area bicolored, upper half velvety black and lower half yellow; palpi yellow; by having fine posteroventral and anteroventral hairs on front tarsi of male; no dark smudge at apex of subcosta; by the development of the prominence on the sixth tergum; and by the character of the trifoliate process of the male. Rather small species readily differentiated from other Hawaiian *Atherigona* by the characters given in the key above.

Head nearly quadrate, shaped as in most other *Atherigona*. Densely silvery gray pollinose except for upper half of each frontal area, velvety black and lower clear yellow, also upper median portion of occiput subopaque black. Five bristles in the frontal row, extending to level of bases of antennae. Antennae dark brown to black, third segment extending almost to oral margin in male, shaped as in figure 24b. Aristae short pubescent, second joint equal or slightly longer than first. Palpi yellow, curved upward at apex in male and with a few short, black spicules along posterodorsal line and with a clump of about four bristle-like subbasal, posteroventral setae (fig. 24c). The apical portion of the palpus is rather flattened ventrally and densely covered with fine, short, yellow pile. Palpus of female rather long and slender, gently curved upward, lacking the subbasal spines or the apical patch of fine, yellow pile. Thorax black in ground color except for yellow humeri and propleura; prosternum yellow on anterior portion, brown to black posteriorly. Densely gray pollinose with no indication of brown vittae on mesonotum. Basal setae of scutellum about one-fourth as long as subbasal, lateral bristles, and the disc is sparsely setose. Legs of male entirely yellow except for blackish front tibiae and tarsi, the basitarsi with a line of posteroventral and a line of anteroventral fine, erect, cilia. Wings entirely hyaline, crossvein r-m situated near basal third of cell 1st M_2 (fig. 24a). In the females the front femora are black at their apices and the hind tibiae and tarsi are faintly tinged with brown. Front tibia devoid of bristles except at apex. Mid tibia with one small, median, posterior bristle; hind tibia with one anterodorsal at middle, one anterior and one posterior at apical two-thirds, and one preapical dorsal bristle. Abdomen

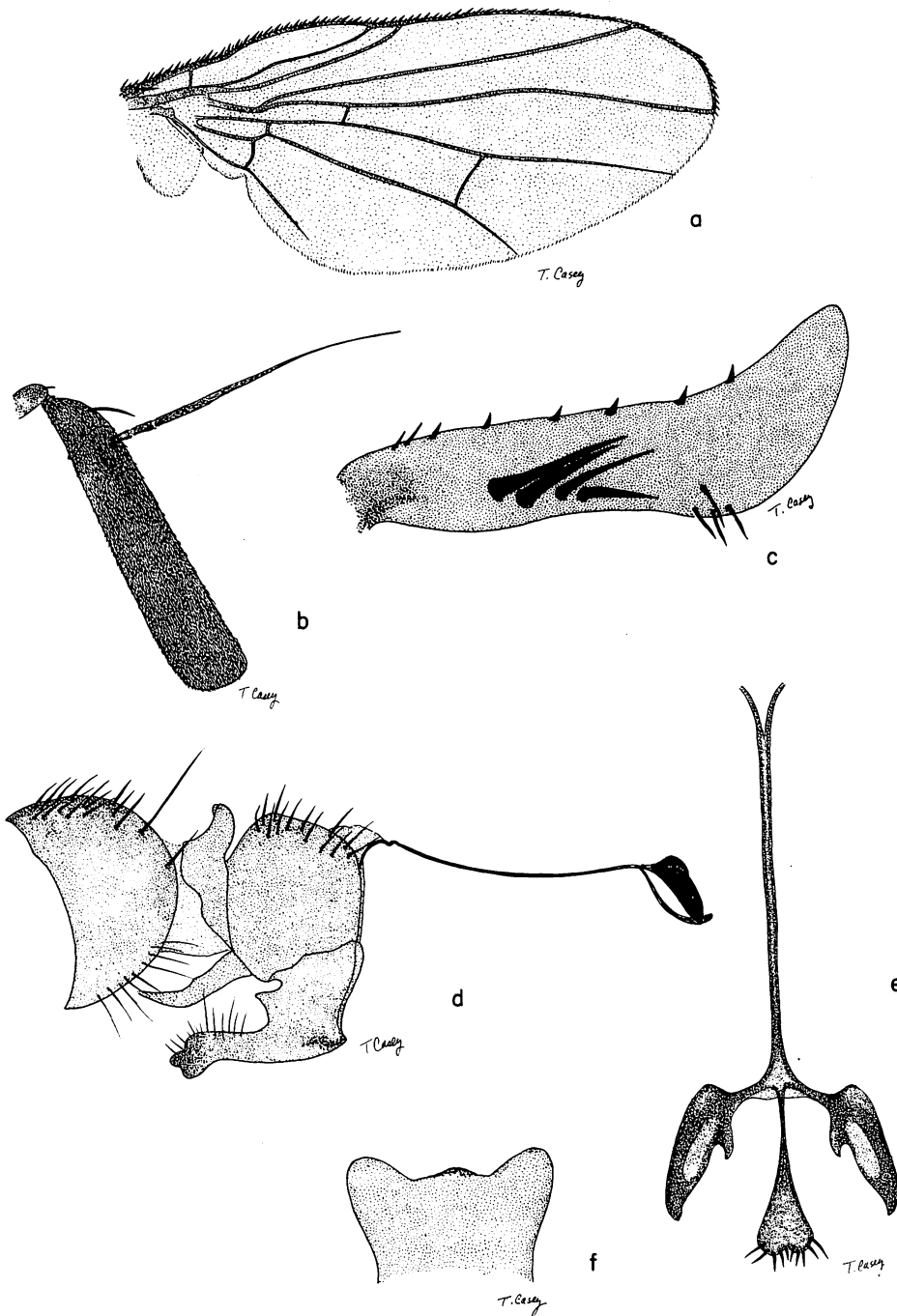


Figure 24—*Atherigona reversura* Villeneuve: a, wing; b, antenna; c, palpus of male; d, male genitalia, lateral; e, trifoliate process; f, prominence on sixth tergum.

mostly yellow, terga one and two lacking dark markings in male, three with a long, shining black spot on each side, enlarged on inner sides on posterior portion. Fourth tergum with a pair of oval black spots; fifth entirely yellow or sometimes with a pair of tiny brown spots. Genitalia as in figure 24d. The prominence on the sixth tergum is indistinctly trilobed as seen in end view (fig. 24f). The trifoliate process of the cercal plates has a small subbasal lobe on inner margin of each dorsal process and the median process is bilobed (fig. 24e). In the female the first three abdominal segments are yellow except for a tinge of brown down the median portion. The fourth and fifth terga each have a pair of oblong to wedge shaped spots.

Length of body: male, 3.0 mm.; female, 3.5–3.7 mm.

Subgenus **ACRITOAETA** Grimshaw

Acritochaeta Grimshaw, 1901, Fauna Hawaiiensis 3:41. Type-species, *pulvinata* Grimshaw, by monotypy, = *orientalis* Schiner.

Differentiated from typical *Atherigona* by secondary sexual characters: the males having the front femora strongly constricted dorsally before apex (fig. 25c); palpi gently curved (fig. 26e), not clavate; lacking a long stalked trifoliate process of the cercal plates (fig. 25a) or a strong protuberance on the sixth abdominal tergum.

Members of this subgenus breed in decaying organic matter, especially plant materials, and are scavengers and apparently sometimes predators on other larvae.

Two immigrant species fit here.

Atherigona (Acritochaeta) hendersoni Malloch (figs. 25a–d)

Atherigona hendersoni Malloch, 1923, Ann. Mag. nat. Hist. 12(9):184. Type-locality: Henderson Island.

Oahu and Hawaii. First recorded by Hardy (1952a). Earliest collection record, Manoa Falls, Oahu, April 1947.

Immigrant. South Pacific: Henderson Island and Samoa.

Habits: Probably a scavenger. Adults have been collected at baits of rotting fish, shrimps, bananas, and casein hydrolysate. They have been reared from rotting stems and bark of *Clermontia*, *Dracaena*, *Tetraplasandra*, *Reynoldsia*, *Acacia koa*, and *Opuntia*.

This species is readily separated from *orientalis* by the brown marking at apex of wing; the three prominent brown vittae down mesonotum; all yellow legs of male; by having a brown vitta down middle of abdomen over terga 2–5; and male palpus straight, densely long yellow pilose on underside at apex (fig. 25e).

The interfrontal area is largely dark brown to blackish and the prosternum is rufous. The third tergum of the abdomen (4th tergum of Venturi et al.) is greatly expanded on sides so that lateral margins come together on genitalia

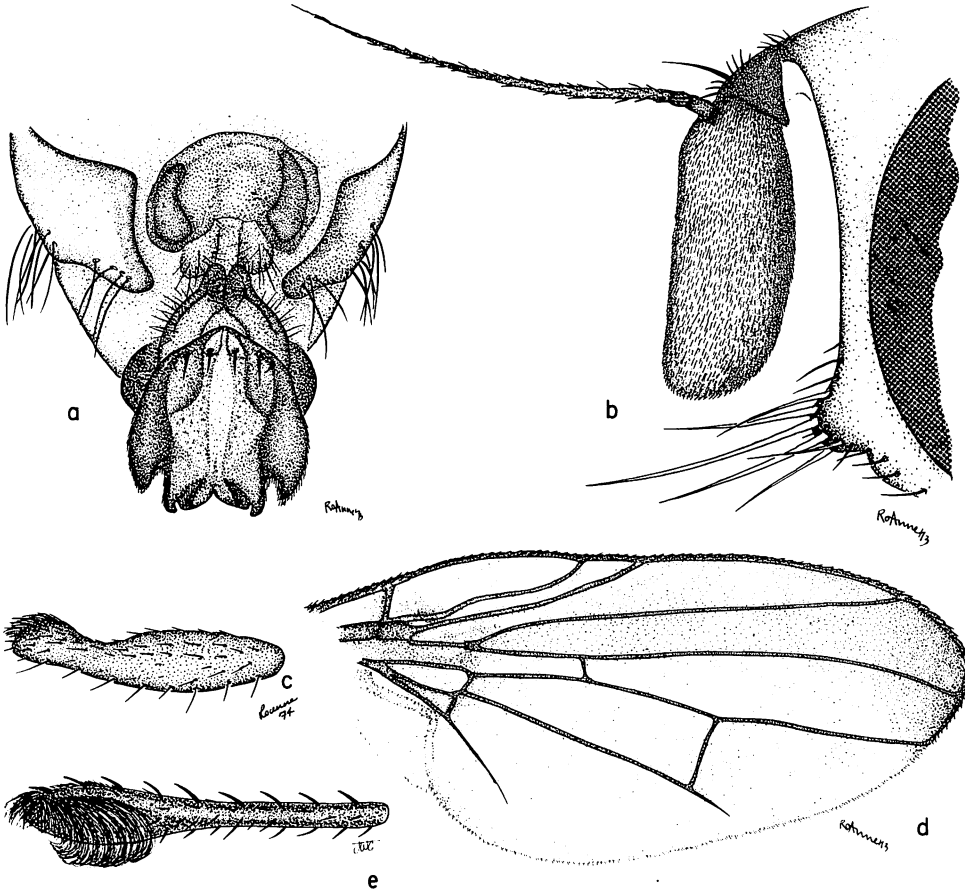


Figure 25—*Atherigona hendersoni* Malloch: a, male genitalia, ventral; b, anterior portion of head and antenna; c, front femur of male; d, wing; e, palpus of male.

when in resting position; the sides of the sclerite are moderately long yellow setose. Also, the male genitalia are characteristic (fig. 25a). The front femur of the male is as in figure 25c, the antenna as in figure 25b, and the wing, figure 25d. From the dark marking at apex of wing this species would appear to resemble *A. jacobsoni* Malloch, from Fort de Kock (Bukittinggi), Sumatra, but that species has subshining black vittae on mesonotum and markings on scutellum, and legs of male have front and mid tibiae and all of tarsi black, and front tibia with three or four long, black anterior bristles or hairs at apex. Also the front tarsus has erect, fine anterior hairs.

***Atherigona (Acritochaeta) orientalis* Schiner (figs. 26a-f)**

Atherigona orientalis Schiner, 1868, in *Reise der österreichischen Fregatte Novara*, Zool. Dipt. 2(1):295. Type-locality: Nicobar Island.

Coenosia excisa Thomson, 1869, in K. svenska fregatten Eugenie's resa, Zool. Dipt. p. 560. Type-locality: Burma (Ross Island).

Acritochaeta pulvinata Grimshaw, 1901, Fauna Hawaiiensis 3:42. Type-locality: Honolulu, Hawaii.

Atherigona varia of Malloch, 1921, Ent. News 32:107, not Meigen.

Common over all the islands.

Immigrant. Cosmopolitan.

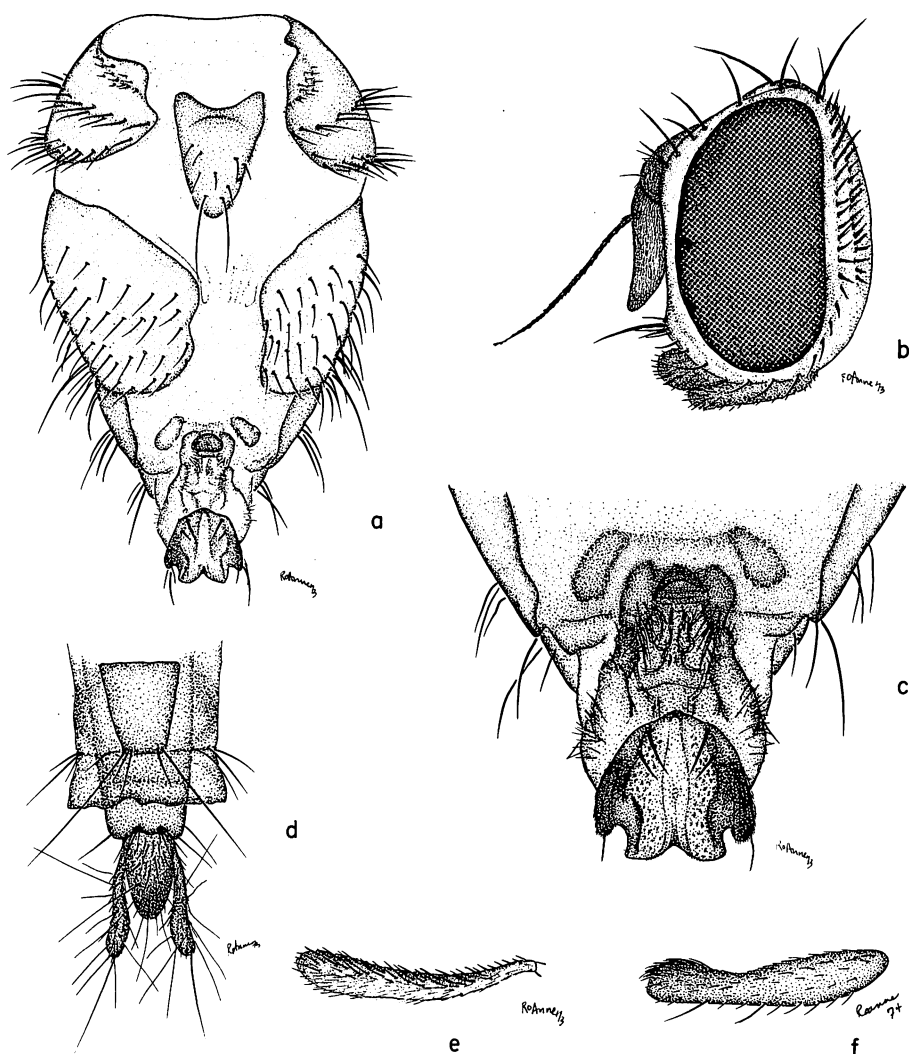


Figure 26—*Atherigona orientalis* Schiner: a, male abdomen, ventral; b, head, lateral; c, male genitalia, ventral; d, female ovipositor, ventral; e, palp of male; f, front femur of male.

Habits: Probably a predator, it lives in all sorts of rotting plant and animal matters. Bohart and Gressitt (1951:111) reported the larvae preying upon larvae of *Dacus cucurbitae* Coquillett and *Limnophora plumiseta* Malloch on Guam.

This species appears to be closely related to *A. flavipalpis* Malloch, which is widespread over the Pacific. Malloch described this as a variety of *excisa* but Snyder (1965:248) gave it specific status, even though "the male genitalia of it and *excisa* are identical, but the absence of dark color at base of palpi and absence of fine, pale hairs on the ventral portion of the fourth abdominal sternite [sic] in the male will distinguish *flavipalpis* from *excisa*." Snyder obviously was referring to sides of tergum not the sternum.

It is readily differentiated from the only other known *Acritochaeta* in Hawaii by having the wings entirely hyaline; interfrontal area mostly orange to rufous; mesonotum and scutellum densely gray pollinose with three rather indistinct brown vittae; male palpus gently curved, with short, fine, yellow pile on apical half ventrally (fig. 26e). Head as described above and as in figure 26b. Interfrontal area orange-rufous especially on lower half; often brown to black on upper portion. Eye orbits, occiput, and face densely silvery gray pollinose. Antennae black, third segment three to four times longer than wide (fig. 26b). Palpi largely brown, or fuscous, especially on apical portion. That of male slender, slightly curved upward, and with short, fine, yellow pile on apical half of ventral portion (fig. 26e). Thorax densely gray pollinose, black in ground color except for yellow humeri and margin of scutellum. With three rather faint brown vittae extending down mesonotum. Prosternum shining black or reddish black. Legs mostly yellow except for brown tarsi; also apices of front femora and tibiae of male are brown, and front femora and tibiae of female are mostly brown. Wings hyaline, r-m crossvein at middle of cell 1st M₂. Abdomen mostly yellow in ground color with a pair of prominent spots on sides of terga 2-5 and with a rather indistinct brown median vitta over terga 2-3. In some female specimens this extends at least partially onto fourth tergum. Second sternum of male with two prominent apical setae, and the third and fourth sterna are either completely lacking or atrophied and not sclerotized so that the venter of the abdomen is largely membranous. The third and fourth terga are fused together into a large plate which extends well onto the venter (fig. 26a) and obviously serves as a protective covering for the genitalia when folded into normal position; this is dark setose on sides. Female ovipositor as in figure 26d. The genitalia are as in figure 26c.

Length: body, 4.0-5.0 mm.; wings, 3.0-4.25 mm.

Tribe PHAONIINI

Genus **GYMNODIA** Robineau-Desvoidy

Gymnodia Robineau-Desvoidy, 1863, Hist. nat. Dipt. env. Paris 2:635.

Type-species, *pratensis* Robineau-Desvoidy, by monotypy.

For synonymy refer to Snyder (1965:277) and to Pont, in Delfinado and Hardy (1977).

Differentiated by having the front rather strongly narrowed in the male; eyes and arista bare; head with front sloping, antennae near middle of head and aristae arising at level of lower two-fifths of eye; two strong presutural pairs of dorsocentrals; lower sternopleural bristle situated rather near and almost directly below posterior bristle (fig. 27e); prosternum, pteropleura, and hypopleura bare.

Only one species in Hawaii.

***Gymnodia arcuata* (Stein) (figs. 27a-e)**

Limnophora arcuata Stein, 1898, Berl. Ent. Z. (1897) 42:201.

Widespread over the islands. One of the commonest species in the native forests to about 5,000 feet elevation.

Immigrant. North America to Ontario, Canada.

Bionomics: We have no information on the biology of this species. The mating swarms are commonly seen in the native forests in clearings or areas where the sun is penetrating through the trees.

In Hockett's key to North American species it runs near *cilifer* Malloch by having the palpi and tibiae largely black and the vittae on the mesonotum suffused, not sharply defined. It is differentiated by having the anteroventral bristles of hind femora confined to distal half, not extending the entire length, and fifth sternum of male very sparsely setose, with only a few setae in middle of concave area of hind margin (fig. 27c), rather than with a dense series of long fine bristles around caudal emargination.

Entirely black flies, thorax and abdomen gray pollinose and with brown markings. Eyes of male close together on front, at narrowest point frons scarcely wider than median ocellus. Mesonotum with three, rather broad, and not clearly defined, brown vittae. Legs entirely black, except for a tinge of rufous on the knees. Abdomen silvery gray pollinose with base of tergum 1 + 2 brown to black. Terga 3 and 4 each with a pair of large submedian brown spots before apex and a pair of small submedian brown spots at base. Tergum 5 with a pair each of rather small, brown, preapical and basal spots. The brown abdominal spots vary considerably in size and shape, often the lateral pairs will be joined longitudinally. Fifth sternum as in figure 27c and male genitalia as in figures 27a,b. Female ovipositor as in figure 27d.

Length of body, 4.0-6.0 mm.

Subfamily MYDAEINAE

According to Vockeroth (1972:5) "the Mydaeinae of New Guinea and Oceania may be distinguished from other regional subfamilies of Muscidae by the following combination of characters: abdomen of ♀ with 5 pairs of spiracles; ♀ cerci short sclerotized and haired only on the outer surface, and protruding little, if at all, beyond hypoproct (Fig. 15, 118-126, etc.); node of R_s with setae on ventral surface and usually also with setae on dorsal surface;

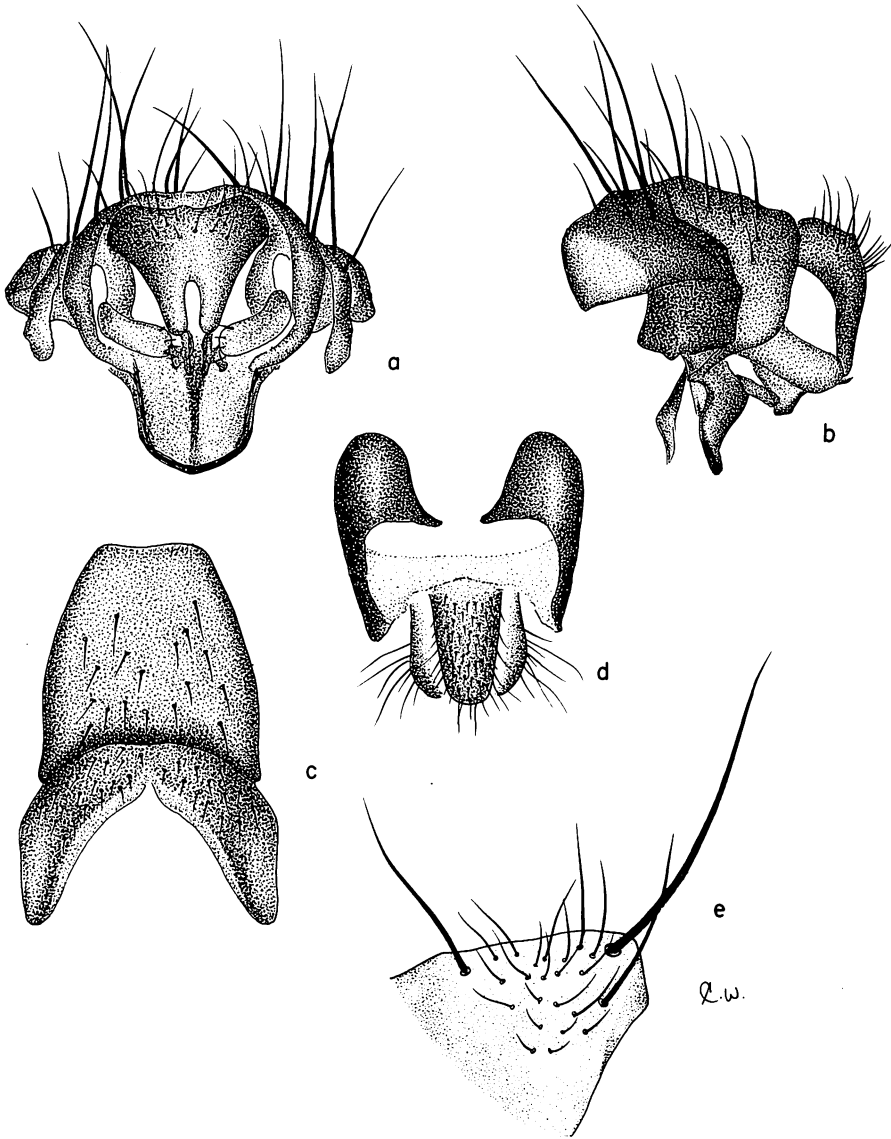


Figure 27—*Gymnodia arcuata* Stein: a, male genitalia, ventral; b, male genitalia, lateral; c, fifth sternum of male; d, female ovipositor, ventral; e, bristles on sternopleuron.

prealar bristle usually present and distinct, if absent then hind tibia with a distinct anterodorsal apical bristle, which is at least as strong as dorsal apical bristle, hind tibia without a posterodorsal bristle or with at most a weak one which is not longer than tibial diameter." For a detailed description of the subfamily refer to Vockeroth (1972:7-9). Only one genus in Hawaii.

Genus **GRAPHOMYA** Robineau-Desvoidy

Graphomya Robineau-Desvoidy, 1830, Acad. Roy. des Sci., Mém. présent par divers Savans [ser. 2], 2:403. Type-species, *Musca maculata* Scopoli, by subsequent designation (Rondani 1856:91).

Graphomyia, emend.

For synonymies refer to Arntfield (1975).

Differentiated from other Muscinae in Hawaii by having the arista and beret long-haired, in combination with pteropleura bare; only two sternopleural bristles, both posterior; face with a distinct, rather broad carina between antennae; propleura and prosternum bare; lower calypter large, reaching base of scutellum and with apical margin transverse or truncate; vein $M_4 + 5$ setose above and below beyond the node, and the curvature of the apical portion of vein $M_1 + 2$ as in figure 28a.

For treatment of this genus refer to Arntfield (1975, revision, N. America), Vockeroth (1972:113), and to Van Emden (1965:544).

***Graphomya occidentalis* Arntfield (figs. 28a-c)**

Graphomya occidentalis Arntfield, 1975, Can. Ent. 107:285. Type-locality: Riverside, California.

Oahu, Maui, Hawaii. First reported March 1948 (Joyce 1949).

Immigrant. California to Mexico.

Biology and habits: The larvae of *Graphomya* are said to breed in rotting organic matter including excrement and according to Keilin (1917) are aquatic to subaquatic. The first two instars are apparently scavengers and the third is predaceous on other fly larvae (refer to Van Emden 1965:544). We have no biological data on this species in Hawaii.

Easily differentiated from other Hawaiian muscids by the generic characters given above. This is a moderately large species somewhat resembling the house fly except for its larger size. The body is largely gray, with a distinctive pattern of black lines down the mesonotum and over scutellum (fig. 28c), and with brown to black spots on the abdominal terga. The sides of first four terga are broadly yellow to rufous in ground color. Sides of front strongly diverging anteriorly. Eyes densely long-haired above. At narrowest point the eyes of the male are separated by a distance equal to one-third to one-half greater than the width of the ocellar triangle. The parafrontals are continuous to the vertex; are narrow on upper portion; below the ocelli they are less than half the width of the interfrontalia, the latter is opaque black and is rather strongly broadened from ocelli to the lunule. The parafrontals and parafacials are densely silvery gray pubescent with a slight golden tinge as seen in direct light. The rostrum is rather elongate, approximately equal in length to lower margin of head. The lower calypter light brown. Only one postsutural intraalar bristle present. Wing as in figure 28a. Humeri with only two strong bristles and hind tibiae

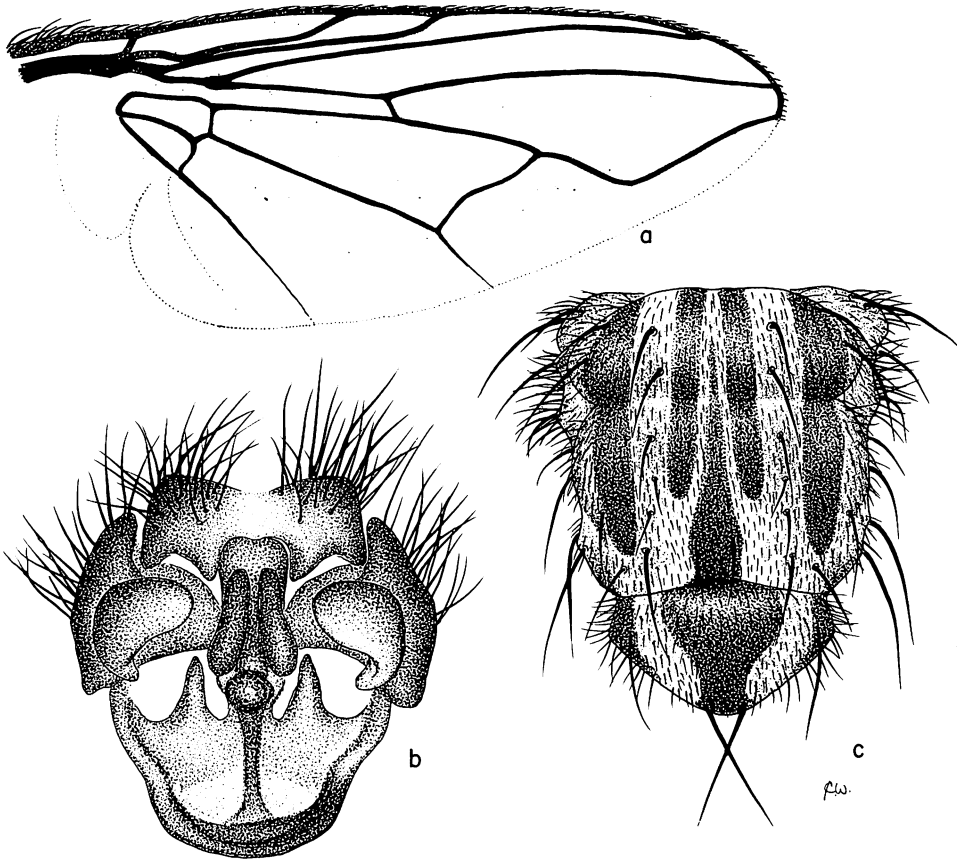


Figure 28—*Graphomya occidentalis* Arntfield: a, wing; b, male genitalia, end view; c, thorax, dorsal.

lacking posterodorsal bristles and with only one short anterodorsal in median portion.

The male genitalia are as in figure 28b.

Length of specimens on hand: body 7.75–8.0 mm.; wings, 6.75–7.0 mm.

For a detailed description refer to Arntfield (1975:285).

Subfamily LIMNOPHORINAE

The only representative of this subfamily in Hawaii is the genus *Lispe* Latreille. This has commonly been treated in the literature under the subfamily Lispinæ but Hennig (1965:61) has placed it as a species group under Limnophorinae, tribe Limnophorini.

The group is readily differentiated by having setulae on the pteropleura; eyes of both sexes widely separated and margins of front convex (fig. 30a);

palpi clavate, flattened, and rather spoon-like (fig. 30c); rostrum slender, heavily sclerotized and polished; labella small, with large praestomal teeth (fig. 30c); and ninth sternum of female rather elongate and with characteristic short bristles or spines at apex (figs. 30h, 31g).

Genus **LISPE** Latreille

Lispe Latreille, 1796, Préc. des caract. génér. des Ins., p. 169. Type-species, *Musca tenaculata* De Geer. Subsequent monotype by Latreille (1802:462).

Lispa, error or emend.

For synonymy refer to Pont, in Delfinado and Hardy (1977).

The genus in Hawaii can be readily differentiated by the subfamily characters given above. Also by having the arista long plumose on basal half; the parafacials setose over their whole length; the metathoracic spiracle with one to several black, bristle-like hairs on hind margin; no prealar bristles present and body densely gray pollinose with brown markings on abdominal terga and on mesonotum. The male genitalia are distinctive (figs. 30d, 31a,b).

These flies are similar in many ways to *Lispocephala* Pokorný, the sternopleural bristles are arranged in an equilateral triangle. The adults as well as the larvae are predaceous and prominent cutting teeth are present on the inner edges of the labella.

The adults are often found near ponds or streams and the larvae of some species of *Lispe* are aquatic. Four species are present in Hawaii.

Three apparently endemic species occur in Hawaii. These have been referred to in the literature collectively as *metatarsalis* Thomson, and this has been considered a synonym of *pygmaea* Fallén (ref. Hennig 1960:451). I have examined specimens of *pygmaea* from Greece and England, received from A. C. Pont, and they are very distinct from the species which occur in Hawaii. Our species resemble *pygmaea* by being densely gray to yellow gray pollinose including the epandrium of the male; with three rather faint, longitudinal brown vittae down the mesonotum and five pairs of strong dorsocentral bristles; palpi, tibiae, and basitarsi yellow; front tibia lacking submedian anteroventral bristles, mid tibia with one submedian posterior to posterodorsal, and hind tibia with a submedian anterodorsal but lacking a posterodorsal; abdomen with paired brown spots on the terga. The fifth sternum of the male of *pygmaea* has the lobes rather quadrate, separated by a broad U-shaped concavity (fig. 33b); the surstyli are rather slender, strongly upcurved. The lobes of the cerci are short and thick, densely setose and the posterior gonites (posterior parameres?) terminate in a strong apical spine and lack other spine-like processes (fig. 33a). Also, the vesica of the aedeagus is comparatively small, not conspicuously protruded.

I am most grateful to Adrian C. Pont for reexamining the types of the species described by Thomson and Grimshaw and providing the necessary information for straightening out the taxonomy of this complex of species.

In Snyder's key (1954:12) to Nearctic *Lispe*, these species run to *johnsoni*

Aldrich from the northeastern U.S. and Canada, but these are not related. In his key to the *Lispe* of Micronesia (Snyder 1965:261), these fit near *boninensis* Snyder but the male genitalia of that species are very different.

KEY TO KNOWN HAWAIIAN SPECIES
(including *pygmaea* Fallén)

1. Mesonotum with three rather indistinct brown vittae and the median not extending onto scutellum. Two pairs presutural dorsocentrals. Front tibia lacking submedian, posteroventral bristles. Male surstyli well developed (figs. 29a, 30e, 32a, 33a) 2
 Mesonotum with a prominent median longitudinal vitta continuous over disc of scutellum. Only one pair presutural dorsocentrals. Front tibia with a submedian posteroventral. Male surstyli poorly developed (fig. 31b) and female genitalia as in figures 31g,h. Southern Europe, North Africa, and Oahu **pectinipes** Becker.
2. Lobes of male cercus terminating in a sharp point or tooth at lower apex (figs. 29a, 30d) 3
 Lobes of cerci and the surstyli broadly rounded apically, not pointed at lower apices (fig. 32a) 4
3. Lobes of cerci each with a prominent spine at apex. Surstyli rounded apically (fig. 30d). On all the main islands **metatarsalis** Thomson.
 Lobes of cerci acute apically, not with a spine-like point. Surstyli sharply pointed apically (fig. 29a). Lanai, Maui, Molokai, Kauai?
 **argenteifacies** Grimshaw.
4. Surstyli slender, strongly curved upward, and lacking subbasal lobes. Lobes of cerci thick, densely setose (fig. 33a). Posterior gonites (posterior parameres?) terminating in a strong spine-like point and lacking other spine-like processes; and the spiculate vesica of the aedeagus rather inconspicuous (fig. 33a). Lobes of fifth sternum rather quadrate, separated by a broad U-shaped concavity (fig. 33b). Europe, China, Formosa, Pakistan. **pygmaea** Fallén.
 Surstyli broad, not curved, and with subbasal lobes. Lobes of cerci mostly bare on apical halves (fig. 32a). Posterior gonites with 1 preapical dorsal spine and four, partly bifid, scale-like apicoven-

tral structures. Vesica large and prominent (fig. 32a). Lobes of fifth sternum gradually tapered (fig. 32b). Hawaii, Oahu **ponti** n. sp.

Lispe argenteifacies Grimshaw (figs. 29a, b)

Lispe argenteifacies Grimshaw, 1901, Fauna Hawaiiensis 3(1):30.

Endemic. Lanai (Type-locality: Koele Mts., one male syntype in the British Museum [Natural History] is herewith designated as the Lectotype), Maui, Molokai, and Kauai?

Fitting near *metatarsalis* Thomson but slightly larger, body, 6.75–7.5 mm.; in body size closely resembling *ponti* n. sp. *L. argenteifacies* is characterized by both the surstyli and the lobes of cerci terminating in sharp spine-like points at lower apices (fig. 29a), also the posterior gonites are rather similar to those of *ponti* n. sp., but the apicoventral scale-like processes are not bifid and are arranged as in figure 29a. The aedeagus is very large, the vesica well developed, conspicuous, heavily spinulose. The fifth sternum has a moderately broad U-shaped concavity in middle of hind margin (fig. 29b).

The specimens examined are consistently gray pollinose with yellow-gray on mesonotum and the front and the face silvery tomentose. It fits the description of *metatarsalis* except for the genital characters. The females have not been definitely associated. One male specimen on hand has a submedian posterior bristle on one of the front tibiae; this is an aberration.

Nothing is known of the habits of this species; specimens on hand are all from higher elevations on the mountains: 3,000–3,700 ft. on Molokai; 3,000–5,000 ft. on Maui.

Lispe metatarsalis Thomson (figs. 30a–h)

Lispe metatarsalis Thomson, 1869, K. Svenska Vetensk. Akad., Kongl. svenska freg. Eugenies resa pt. 2, Zool. 1:562. Type-locality: Honolulu. Type male in the Natural History Museum, Stockholm. Adrian C. Pont, British Museum (Natural History), has studied the genitalia of the type and has clarified (*in litt.*) its status.

Lispe cupreigena Grimshaw, 1901, Fauna Hawaiiensis 3(1):31. **New synonym.** Confirmed by Adrian C. Pont who dissected the type male. Type-locality: Waialua, Koolau Mt. range, Oahu. Type male in British Museum (Natural History).

This has been referred to in most of the Hawaiian literature under "*Lispa*" and was incorrectly recorded as *pygmaea* Fallén (Hardy 1972).

Endemic. Common over all of the main islands, ranging from sea level to 10,000 feet. It is by far the most common species in Hawaii; by comparison the others are rare.

Bionomics: An excellent account of the biology and habits was given by Williams (1938:114). He said the adults are commonly found on muddy shores of marshes, ponds, reservoirs, and sluggish streams, and the larvae are

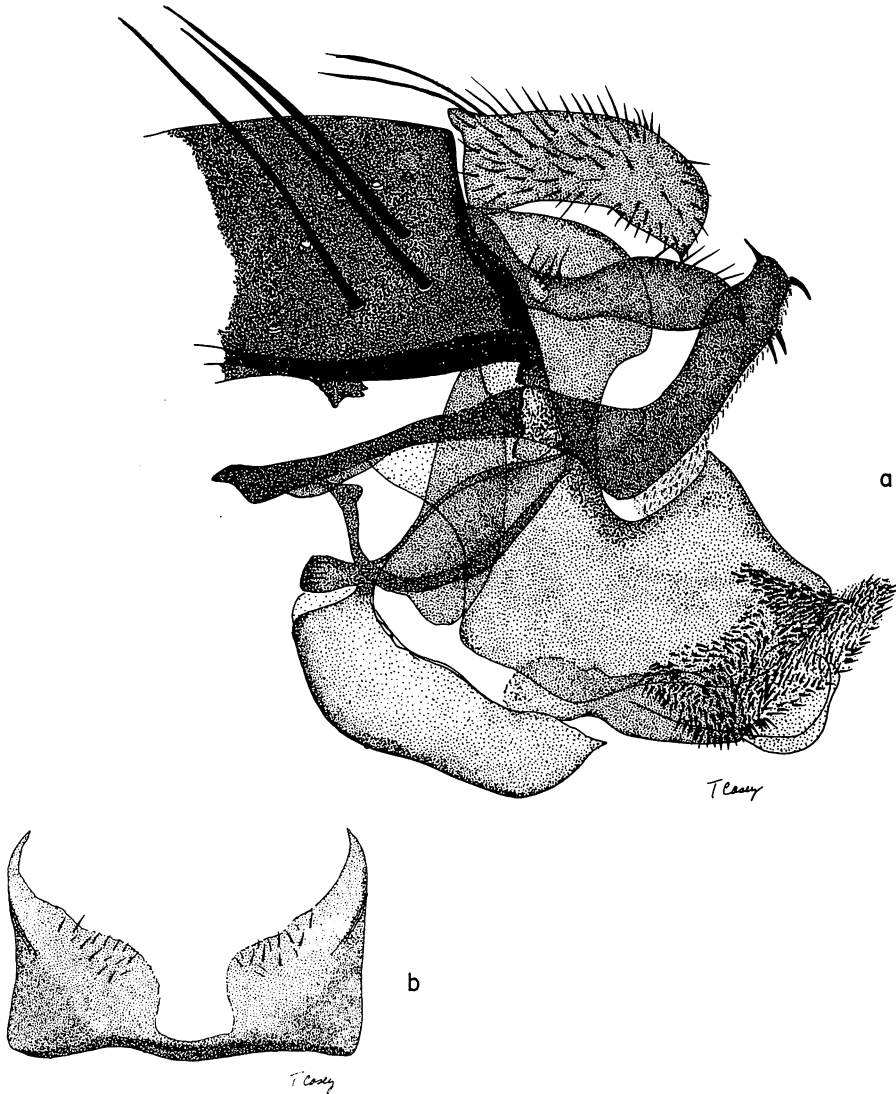


Figure 29—*Lispe argenteifacies* Grimshaw: a, male genitalia, lateral; b, fifth sternum of male.

aquatic or semiaquatic, living in algae on the margins of streams or ponds. He said the larvae are also found "among debris and decaying organic matter accumulated at the leaf bases of the ieie vine (*Freycinetia arborea* Gaud.)." This species is obviously highly adaptable to a rather wide range of habitats. The adults are found commonly over the wetter portions of the islands from pond and stream situations in the lowlands to high on the mountain slopes where there is no standing water.

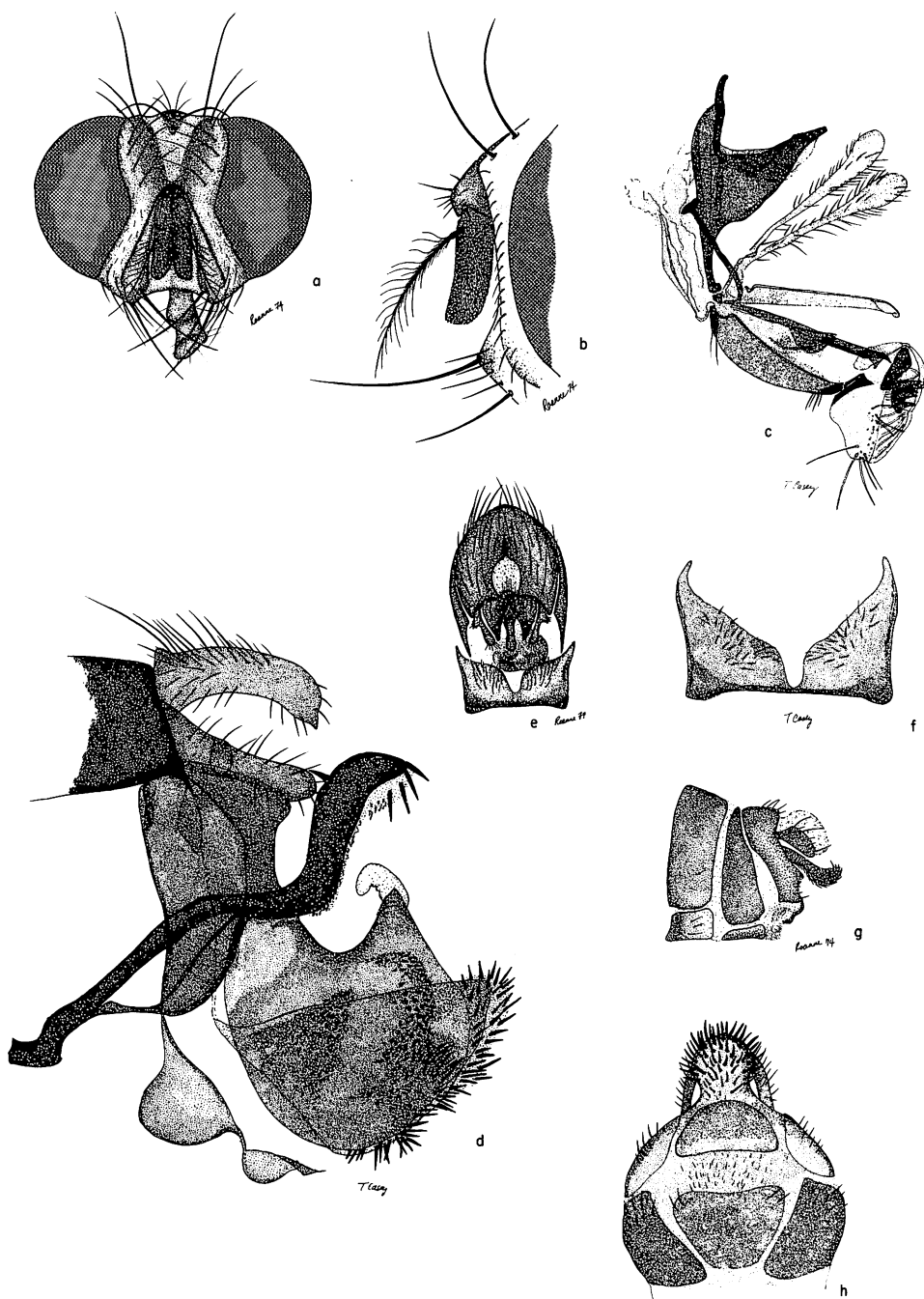


Figure 30—*Lispe metatarsalis* Thomson: a, head, front view; b, anterior portion of head, lateral; c, mouthparts and palpi; d, male genitalia, lateral; e, male genitalia, ventral; f, fifth sternum of male; g, apical portion of female abdomen, lateral; h, female ovipositor, ventral.

Williams (*loc. cit.*) recorded the adults feeding upon *Psychoda* and *Milichiella* and found them in association with *Chironomus* and with ephydrid flies. Wirth (1947:150) observed *Lispe* (as *Lispa*), "probably *metatarsalis* Thomson, a common anthomyiid predator stationed on boulders at the beach waiting for passing insects." They obviously prey upon any small flies (insects) which they can capture. One specimen on hand was collected feeding on an introduced Tephritidae (*Dioxyna sororcula* Wied.).

Fitting the characteristics of *pygmaea* except for the male genitalia. The color of the pollinosity of the head and thorax varies considerably from gray to yellow-gray or golden. Head and mouthparts characters as in figures 30a-c. It is differentiated from the other Hawaiian species by its consistently smaller size, body averaging 5.0-5.5 mm.; by lobes of cerci, each having a prominent apicoventral tooth and the surstyli rounded at apices (fig. 30d). The posterior gonites (posterior parameres?) are characteristic because of the presence of a strong dorsal spine and 1-5 apicoventral, simple, scale-like processes (fig. 30d). Ventral aspects of genitalia as in figure 30e. The fifth sternum has a rather narrow U-shaped concavity in middle of hind margin (fig. 30f). The female genitalia are as in figures 30g,h.

***Lispe pectinipes* Becker (figs. 31a-h)**

Lispa pectinipes Becker, 1903, Mitt. Zool. Mus. Berlin 2:113. Type-locality: Egypt.

Oahu. First reported by Au (1970:488) as *Lispa leucospila* (Wiedemann); specimens collected in April 1968 from a lawn at Hickam Air Force Base, Oahu. To date we have seen only 6 specimens from 4 localities on the leeward side of Oahu.

Immigrant. Southern Europe, north Africa.

Hennig (1960:439) and other workers treated *pectinipes* as a synonym of *leucospila* but Lyneborg (1970b:43) reported this was an error. He examined syntypes of both *pectinipes* and *leucospila* and found them to be distinct species. The species figured by Hennig (*loc. cit.*, text fig. 154; pl. xx, fig. 399; pl. xxi, fig. 415) under the name *leucophila* was actually *pectinipes*.

Lyneborg (*loc. cit.*, figs. 20-25) depicts the differences in the male genitalia of these two species. He shows that they may be differentiated by the anal sclerotization (mesolobus), surstyli, and fifth sternum of the male. As seen from end view the lobes of the anal sclerotization are elongate, slender, almost straight-sided for most of their length (fig. 31a), whereas in *leucospila* the lobes are evenly tapered, separated by a narrow V-shaped cleft. Lyneborg said the two are very similar in all external characters except for some differences in the abdominal markings. "In the lectotype of *leucospila* the greyish lateral stripe reaches only to middle of tergite 4 and is therefore separated from the greyish lateral spot on tergite 5. In the lectotype of *pectinipes* this greyish stripe continues to the posterior margin of tergite 4 and is thus confluent with the greyish spot of tergite 5."

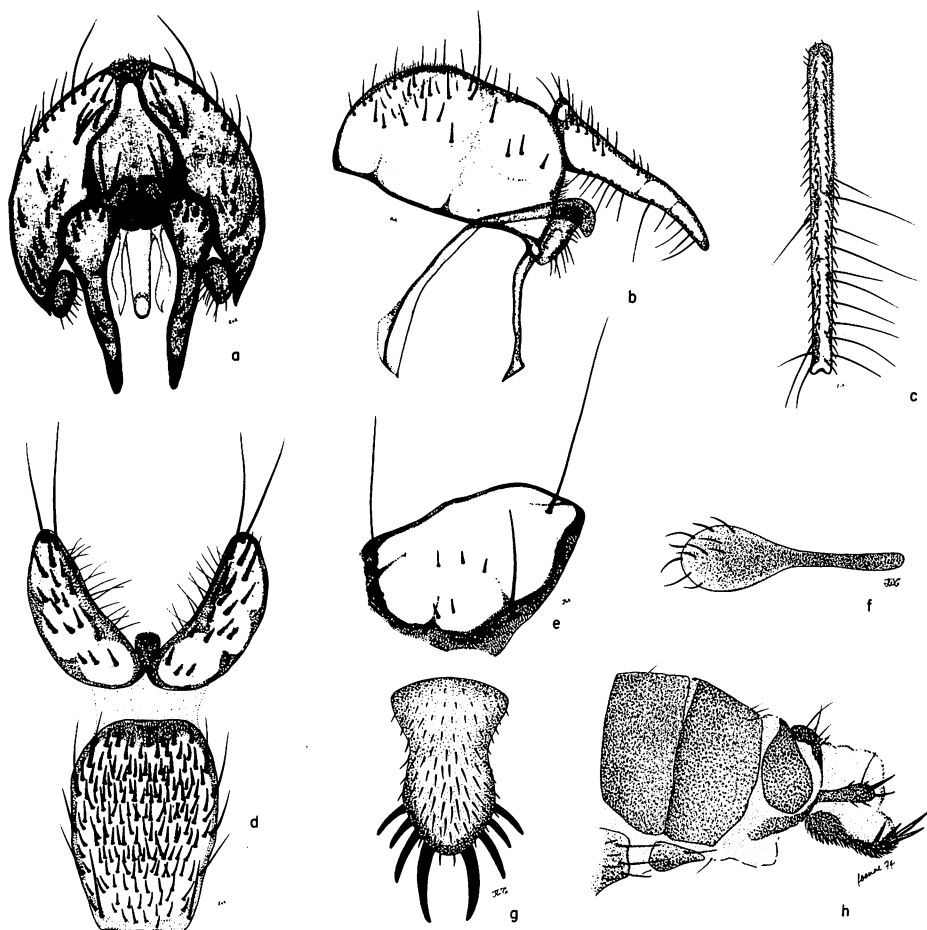


Figure 31—*Lispe pectinipes* Becker: a, male genitalia, end view; b, male genitalia, lateral; c, hind tibia of male, dorsal; d, fourth and fifth sterna of male; e, sternopleuron; f, palpus of male; g, ninth sternum of female, ventral; h, female abdomen, lateral.

This species fits in an entirely different species group than other *Lispe* in Hawaii and would seem to represent a distinct genus. It is easily recognized by the following characters: having a single, rather broad, median, brown vitta extending down the mesonotum over the middle of the scutellum. Abdomen with the dorsomedian portion of each tergum broadly dark brown to black, sides of terga 2-5 also broadly brown to black, leaving (in the males) a broad densely gray pollinose area extending down each dorsolateral portion of abdomen from base of first to about basal two-thirds of fifth tergum. Only four pairs of dorsocentral bristles, one strong presutural, and with first pair of postsuturals small, about one-half normal size. Ventral bristle of sternopleural set closer to the posterior bristle than to the anterior (fig. 31e). Hind tibia of

male with a row of long, posteroventral hairs extending over apical three-fifths of segment (fig. 31c) and with one or two strong anteroventral bristle located near apical third. Crossvein r-m situated at middle of cell 1st M₂. Front tibia with a strong posteroventral bristle near middle and middle tibia with a posterior bristle near basal third of segment. Palpi rather abruptly enlarged before apices (fig. 31f). Fifth sternum of male as in figure 31d. Male genitalia subshining, dark brown to black, completely different from other Hawaiian *Lispe*; the surstyli are poorly developed and the structures are in figures 31a,b.

The female ovipositor is also distinctive, as in figures 31g,h. The female shows dimorphism in the markings of the abdomen, the abdomen is predominantly gray pollinose with a single median brown mark extending over second tergum and over the fifth tergum and with a pair of elongate subshining brown marks extending over terga three and four.

Length: body, 4.0–4.25 mm.; wings, 3.3–3.5 mm.

***Lispe ponti* Hardy, new species (figs. 32a–c)**

Fitting the general characteristics of *pygmaea* Fallén as given above but the resemblance is superficial and the genital characters indicate that these are not related species. The broad surstyli, with subbasal lobes; the differences in the development of the posterior gonites (posterior parameres?) and the aedeagus (fig. 32a) as well as other details will characterize these (see fig. 33 for comparison). *L. ponti* most closely resembles *argenteifacies* Grimshaw because of its larger size. It is differentiated by having the lobes of the cerci and the surstyli rounded apically not pointed at lower apices (fig. 32a); the posterior gonites with four, partially bifid, scale-like processes on apicoventral margin (fig. 32a), and the cleft in middle of hind margin of fifth sternum more narrowly U-shaped (fig. 32c).

MALE. *Head:* Front yellow to brownish gray, especially on frontal triangle and along orbits. Two pairs of proclinate superior fronto-orbitals and four pairs of incurved inferior fronto-orbitals. Face and genae silvery white tomentose. Antennae dark brown to black except for yellow bases of third and apices of second segments. Palpi yellow, rather gradually clavate (fig. 32b). *Thorax:* Yellow-gray pollinose, especially on the dorsum with very faint indications of three brownish vittae on mesonotum. Five strong pairs of dorsocentrals, two presutural. Only prescutellar acrostichals present. Suprasquamal ridge bare. *Legs:* Mostly dark brown to black covered with gray pollen; tibiae, basal tarsomeres and extreme apices of femora yellow. Front tibiae lacking submedian bristles. Middle tibia with one submedian posterodorsal and hind tibia with one anterodorsal. *Wings:* Tinged yellow-brown. Venation like that of *pygmaea*, crossvein r-m situated at about apical three-fifths of cell 1st M₂. *Abdomen:* Gray, with a faint yellow tinge, pollinose with rather small round paired spots on terga three and four and but faint indications of markings on terga two and five. Fifth sternum as in figure 32c. Male genitalia as noted above and as in figure 32a.

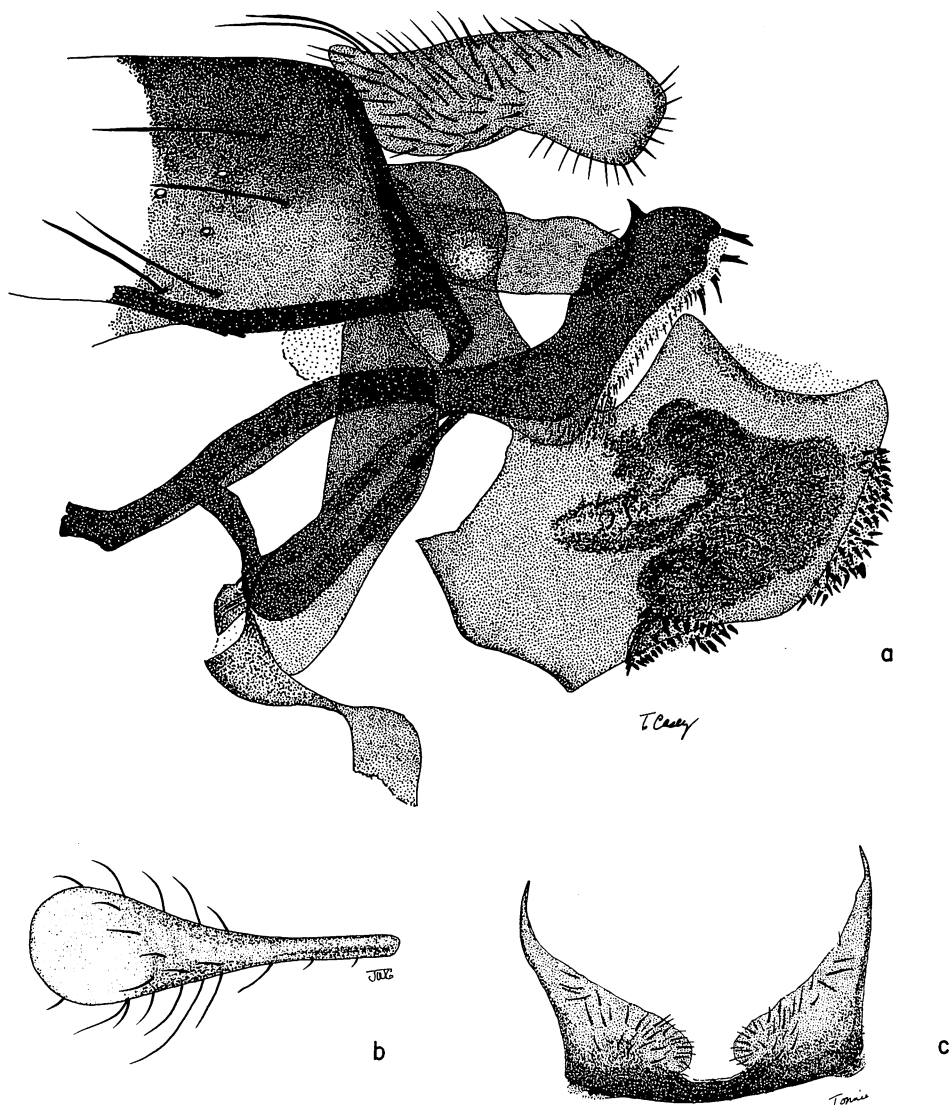


Figure 32—*Lispe ponti* n. sp.: a, male genitalia, lateral; b, male palpus; c, fifth sternum of male.

Length: body, 6.3–6.75 mm.; wings, 4.75 mm.

FEMALE: Unknown.

Holotype male: Makalawena Tract, Opaepula pond, Kona coast, Hawaii, collected in grass at edge of semibrackish pond near ocean, February 12, 1970 (D. E. Hardy). Four male paratypes, same data as type and one male Maunawili, Oahu, February 1953 (G. E. Bohart).

Type and allotype in B. P. Bishop Museum. Paratypes in collections of

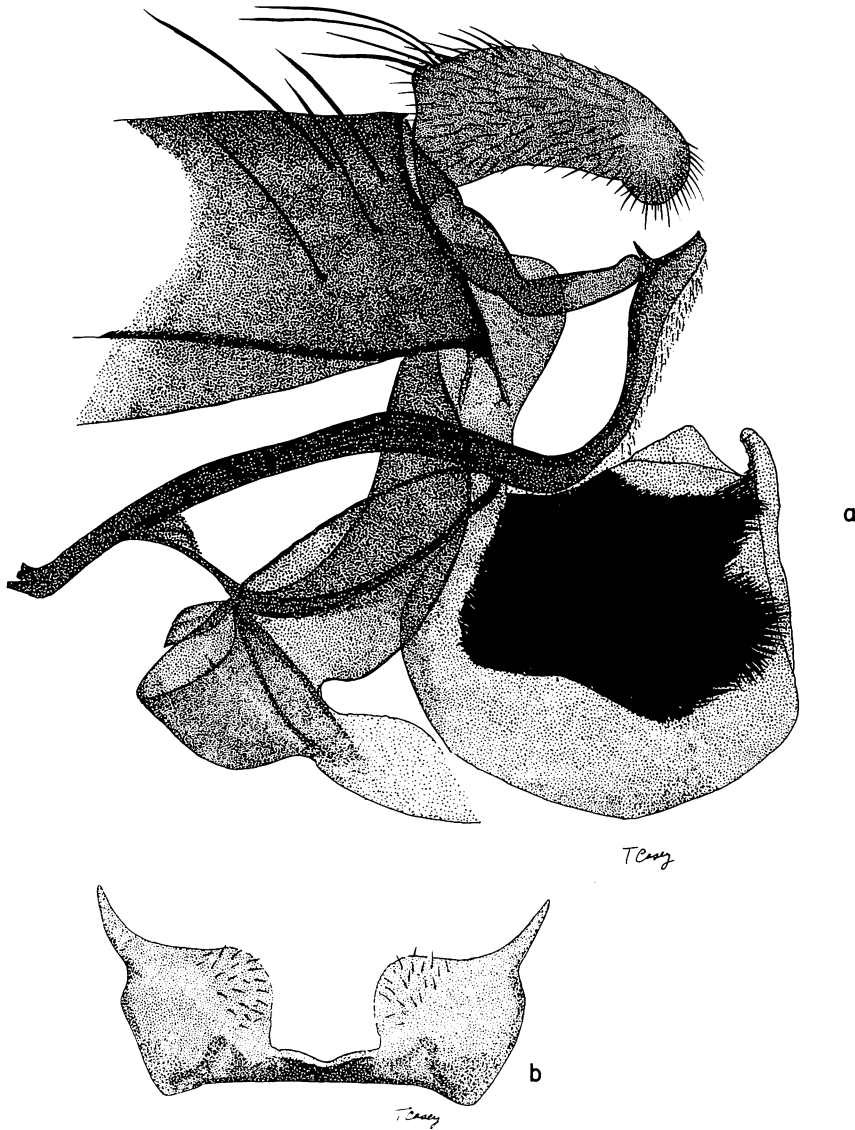


Figure 33—*Lispe pygmaea* Fallén: a, male genitalia, lateral; b, fifth sternum of male.

British Museum (Natural History), U.S. National Museum, and the University of Hawaii.

It is a pleasure to name this species after Adrian C. Pont, British Museum (Natural History), who has been such a tremendous help to us in working out the Hawaiian muscid flies and who was directly responsible for straightening out the taxonomy of this species complex of *Lispe*.

Subfamily COENOSIINAE

As represented here, the members of this subfamily are characterized by having the dorsocentral bristles strong, with three postsutural and almost always two presutural; hind tibia with two posterodorsal bristles on median portion; and, as seen in lateral view, head conspicuously higher than long and antennae situated well below upper margin of head; front approximately equal in both sexes and interfrontal bristles absent. In combination with vein $M_1 + 2$ straight, pteropleura bare and sternopleural bristles arranged in an equilateral triangle. The female ovipositor is short, sclerotized, and hairy only on outer surface, it protrudes scarcely beyond the hypoproct (fig. 98b).

Only one genus occurs in Hawaii.

Genus **LISPOCEPHALA** Pokorný

Lispocephala Pokorný, 1893, Verh. zool.-bot. Ges. Wien 43:532. Type-species, *Anthomyia alma* Meigen, by original designation.

Fitting near *Pectinaseta* Stein by having the three sternopleural bristles arranged in an equilateral triangle; frontal triangle prominent, well developed; ocellar bristles strong and two pairs of reclinate bristles on front; mid tibia with one submedian posterodorsal bristle; lower lobe of calypter extending well beyond upper lobe; and scutellum usually with four bristles. Also, two pairs of presutural dorsocentral bristles are present although in some Hawaiian species the anterior pair is rather weak (absent in *perflava* n. sp.). *Lispocephala* is differentiated by having the median posterodorsal bristle of hind tibia strong and the submedian posterodorsal much smaller, rather than having the median bristle very small or absent and the subbasal bristle well developed; no sexual dimorphism in length of hairs on arista and third antennal segment not extending the length of face, except in males of *macrocera* n. sp. and *melanoxenia* n. sp., rather than male arista with long hairs only on dorsal surface and third antennal segment elongate, extending to oral margin.

Refer to Snyder (1965:201, 220), Crosskey (1962:400), and Hennig (1961:481) for taxonomic characters of the genus.

This is another example of a group which has speciated very profusely in Hawaii, with more species developed here than occur over the entire world. The genus is widespread over the Palearctic, Nearctic, Oriental, Pacific, and Ethiopian regions; with just over two dozen Holarctic species, about two dozen Oriental, two African, and two Micronesian. A number of these have been placed under *Pectinaseta* Stein, *Parvisquama* Malloch, and *Cephalispa* Malloch and apparently not more than fifty valid species of *Lispocephala* are known from the entire world outside of Hawaii. One hundred and five species are now described from the Hawaiian islands.

These flies are predacious in both the larval and adult stages; they occupy a wide range of habitats and obviously assert strong biotic pressure upon other endemic insects, especially Diptera. They are commonly associated with

Drosophilidae both in the larval substrates and in the same habitats with the adults. They are voracious feeders and very effective predators on drosophilids, tipulids, chironomids, dolichopodids, and no doubt other flies and possibly other insects.

The substrates containing Drosophilidae have to be examined carefully when brought into the laboratory for rearing to make sure no *Lispocephala* are present. Otherwise they devour everything in the sample.

Some species are aquatic in their immature stages. The larvae and pupae of *philydra* n. sp. are found in mosses and algae in swift running streams; larvae have been recovered from moss submerged two or more feet in the water and they obviously feed upon chironomids, tipulids, and other insects developing in this habitat. The adults are found on wet rocks where the stream is torrential and the rocks constantly being splashed by the spray. They have been observed feeding on Tipulidae, *Telmatogeton* (Chironomidae), and probably also feed upon Ephydriidae and Canaceidae. It is also evident that *fusca* Malloch, *parydra* n. sp., and *kaalae* Williams are also aquatic in their immature stages (ref. Williams 1938:115-118). The adults have been collected on mosses at springs and at least the latter species has been observed feeding on dolichopodids.

For the most part, the adults are difficult to collect and most of the usual techniques of fly-collecting are quite unsatisfactory. The best method we have found is by using a visual technique in connection with our searching for picture-winged *Drosophila*. *Lispocephala* seem to be attracted to the fermenting baits which we use for attracting *Drosophila*, or it may be that they are attracted to other flies coming into the baits. Collecting is done by watching for the adults sitting around on stems, leaves, and so on, in the forest; often they are seen in the near vicinity of the *Drosophila* bait. The adults are very rapid fliers, much more evasive than are the drosophilids. They capture and hold the prey in their front legs, tear through the membrane with their strong prestomal teeth (fig. 119c), usually at the base of a coxa or sometimes on the compound eyes, causing bleeding to occur. Then they appress their labella over the wound and suck all the body fluids from the host.

These flies are in turn preyed upon by other endemic insects. Perkins (1913:clxxxvii) said they are preyed upon by carabid beetles. Crabronid wasps commonly use *Lispocephala* for provisioning their nests (Williams 1927:445). A number of different species have been collected in cells in the nests of *Crabro* and *Zenocrabro*.

The present study treats 105 species; it is estimated that the total fauna probably equals 150-200 endemic species. Bryan (1934:427) listed 37 species, 13 described by Grimshaw and 24 by Malloch. Perkins (1913:clxxxii) speculated there might be as many as 100 species in Hawaii.

The Hawaiian *Lispocephala* divide into a number of species groups, subgroups, and species complexes. In setting up these categories, I am using the concept which is now applied to Drosophilidae, as defined by Bock and Wheeler (1972:4).

Based upon the world classification of *Lispocephala* and related genera the taxa treated as species groups would warrant generic status. From our experience with Hawaiian Drosophilidae, knowing that striking morphological differences may often occur in closely related species, I feel that it is not even advisable, at present, to treat these as subgenera. For the large majority of the species these groupings are very clear cut but a number of intergrades are known which fit borderline between groups.

Lispocephala dentata n. sp., from Maui appears to show relationship with *alma* (Meigen), the type of the genus. The latter runs to *dentata* in the key to Hawaiian *Lispocephala*, and the leg chaetotaxy and most other characteristics are very similar in the two. They are, of course, readily differentiated by the infuscation on the r-m and m crossveins, larger frontal triangle, all black interfrontalia, and very different fifth sternum and genitalia of *alma* (figs. 38a,b,d,e). The relationships of these two may actually be rather remote, nevertheless it does provide a starting point for determining which characters are more primitive and which are derived. We are assuming that *dentata* represents one of the most primitive of the extant Hawaiian species. This then places the alakaiae species group as representing the more ancestral types. This group is characterized by lacking posteromedian bristles on front tibiae, femora not spinose, male surstyli well developed, and no preapical dorsal bristles on hind femora (fig. 38c), or if with a slightly off center preapical dorsal the posterodorsal is lacking.

The evolutionary significance of the presence (fig. 58d) or absence (fig. 38c) of preapical dorsal bristles, accompanied by preapical posterodorsals is open to conjecture. Both conditions occur in all of the species groups and would appear to be of questionable significance. The confluens subgroup of the alakaiae group are differentiated by possessing one or more dorsals near apical 1/5 of segment in addition to having posterodorsals. In the fasciculata group of species (only two strong scutellars) only *fasciculata* Malloch has preapical dorsals, the other species lack these. The species of the ingens group (with a posteromedian bristle on the front tibia) all lack the preapical dorsals except for the seminigra subgroup which possesses these bristles. The brevispina group have approximately half of the species with and half without the preapical dorsals. Also, with the knowledge at hand, it is impossible to speculate as to how many ancestral species may have been involved in the development of the Hawaiian fauna of *Lispocephala*. In light of the detailed story we now have on the evolution of the drosophilids in Hawaii and because forms are present which seem to fit intermediate between the various species groups it is logical to extrapolate that the entire *Lispocephala* fauna could have been derived from one ancestral species. One like *dentata* n. sp., which possessed a preapical bristle on the hind femur in the area intermediate between the dorsal and posterodorsal lines (fig. 38c). On the other hand it is altogether possible that more than one ancestral species is involved. The seminigra subgroup of the pallidibasis group of species would surely seem to have been derived from the same ancestral stem as *tibiseta* Malloch (with a posteromedian bristle on front tibia and broad head)

from Southeast Asia. *L. villosifemora* n. sp. seems to be intermediate between the dexioides and alakaiae groups of species. It possesses most of the characteristics of the former but lacks the posteromedian bristle on the front tibia (at least in the male).

The following arrangement of the species groups is strictly arbitrary and may not be of phylogenetic significance.

KEY TO LISPOCEPHALA

1. Only one pair of strong scutellar bristles, the basal pair two to four times larger than seta-like apical pair . . . *fasciculata* group of species. 2
 - Both pairs of scutellars well developed, about equal in size 8
- 2(1). Thorax black in ground color 3
 - Thorax predominantly pale yellow, pleura entirely yellow 7
- 3(2). Antennae all yellow 4
 - Antennae black, sometimes rufous at inner base of third segment. 6
- 4(3). First two tarsomeres of hind legs of male with a fascicula of stout black bristles at apex (fig. 118c). Fifth sternum of male strongly projected (figs. 118d,e). Hind femora of both sexes with a preapical dorsal bristle and hind tibia with two anteroventral bristles. Hawaii. ***fasciculata*** Malloch.
 - No such fasciculae on male tarsi and the fifth sternum not projected (fig. 122a). Hind femur with a preapical posterodorsal but no dorsal and only one anteroventral bristle on hind tibia. 5
- 5(4). Calypters pale, yellowish white, wings subhyaline. Mesonotum and scutellum gray with no brown markings. Tarsi yellow, faintly tinged with brown at apices. Extension from male cercus with numerous short black spines above, near base; surstyli very slender (fig. 123a). Fifth sternum nearly bilobed at apices, shaped as in figures 123b,c. Kauai ***waialealeae*** n. sp.
 - Calypters and wings brown. Mesonotum indistinctly brown vittate and sides of scutellum brown. Tarsi dark brown to black. Fifth sternum (fig. 122a) and genitalia (fig. 122b) not as above. Hawaii ***uniseta*** n. sp.

- 6(3). Third antennal segment entirely black, elongate, extending approximately to oral margin (fig. 119c). Extension from cercus densely setose dorsally and rather hook-shaped apically. Maui, Molokai. **macrocera** n. sp.
 Third segment red at base on inner margin and not extending to oral margin. Extension from male cercus nearly bare dorsally and surstylus slender, curved downward as in figure 121a. Hawaii **subtilis** n. sp.
- 7(2). Thorax all yellow except for a longitudinal median brown to blackish mark between dorsocentral rows. Mid tibia with one anterior and two posterior bristles on median portion; hind tibia with two anteroventral bristles; front tibia with a strong median posterior bristle in female, lacking in male. Hind femur with one preapical dorsal bristle. Arista long plumose basally. Oahu **pallida** Malloch.
 Mesonotum mostly tinged with brown. Only one bristle on mid tibia, except at apex, it is posterior; hind tibia with one anteroventral bristle; and posterior bristle lacking on front tibia of female. Hind femur lacking a preapical dorsal bristle. Arista pubescent. Kauai **quasipallida** n. sp.
- 8(1). Front tibia with a posterior bristle near middle **pallidibasis** group of species 9
 Front tibia lacking a posterior bristle near middle 46
- 9(8). Mid tibia with only one posterior bristle near middle and no median anterior bristle. Head at least as high as wide as viewed from front. Front comparatively narrow, about two times longer than wide. 10
 Mid tibia with two posterior or posterodorsal and one anterior or anterodorsal bristles near middle (fig. 117a) except in **melanoxenia** n. sp. (fig. 115c). Head wider than high. Front as wide as long . . . **seminigra** subgroup of species 39
- 10(9). Legs mostly or entirely black, not more than bases of tibiae and very narrow apices and bases of femora (in **bispina**) yellow . . . **pallidibasis** subgroup of species 11
 At least bases of femora broadly yellow . . . **dexioides** subgroup of species 23

- 11(10). Front not densely setose, (fig. 98c) only a single row of bristles and hairs on each side, with 3-4 long bristle-like hairs between inferior and superior fronto-orbital bristles. Only 3-4 short black setae above ocelli. Only one vibrissal row on gena and only one intraalar bristle. Mesonotum densely gray on sides, subshining brownish black to chocolate brown medianly. Pleura densely gray pollinose, hind portion of mesopleuron and upper sternopleuron sparsely setose; upper hypopleuron bare. Rims of both calypters yellow. 12
- Front densely setose (fig. 96a), with two rows of prominent hairs, about a dozen situated between the superior and inferior fronto-orbitals and a clump of about a dozen long hairs above ocelli. Two strong intraalars. Mesonotum shining, sub-metallic black, less densely gray on sides. Pleura subshining gray, hind portion of mesopleuron and upper sternopleuron densely black setose; upper margin of hypopleuron with long black hairs. Rim of upper calypter brown. Male abdomen mostly pale yellow white. Maui, Molokai, Oahu, Hawaii **ingens** (Grimshaw).
- 12(11). Males 13
Females 18
- 13(12). Hind femora normal in shape. Hind tibia with a strong anteroventral bristle near middle 14
- Hind femora greatly thickened, flat, slightly concave on ventral surface, and venter densely covered with short black hairs (fig. 99c). Hind tibia lacking an anteroventral bristle but with a row of long bristle-like hairs along anteroventral surface. Maui **planifemorata** n. sp.
- 14(13). Third antennal segment clear yellow. 15
Third antennal segment dark colored, all black or rufous, darkly tinged with brown 17
- 15(14). Mesonotum with a large subshining brown spot over median portion. Hind femora densely fine haired with some of the hairs near apical third about equal in length to the anterodorsal and anteroventral bristles 16
- Mesonotum gray with three brown vittae. Hind femora not densely fine haired ventrally. Molokai and probably Maui **zonata** n. sp.

- 16(15). Palpi entirely dark brown to black. Oahu
 **pallidibasis** Malloch.
 Palpi yellow on apices. Oahu **bispina** Malloch.
- 17(14). Antennae all black, palpi reddish brown to blackish.
 Cercus lacking a dorsal hook-like process. Lanai .
 **lanaiensis** n. sp.
 Third antennal segment reddish brown. Palpi
 rufous. Cercus with a strong dorsal hook-like pro-
 cess (fig. 95a). E. Maui. **hamifera** n. sp.
- 18(12). Mesonotum gray with distinct brown vittae 19
 Mesonotum mostly shining dark brown to black,
 not vittate 21
- 19(18). Abdomen mostly black with gray crossbands, yellow
 in ground color only on sides of terga 1 + 2 and
 narrow anterolateral margins of third tergum. No
 paired black spots on terga 20
 Terga 1 + 2 nearly all yellow; third broadly yellow
 basally. Terga 3 and 4 largely gray pollinose with
 prominent paired shining black spots. Oahu . . .
 **bispina** Malloch.
- 20(19). Pale pollinosity of thorax and abdomen gray. Wing
 distinctly tinged with brown. Molokai and prob-
 ably Maui **zonata** n. sp.
 Pale pollinosity of mesonotum, scutellum, and ab-
 domen golden gray. Wings subhyaline, indis-
 tinctly tinged with brown. E. Maui.
 **hamifera** n. sp.
- 21(18). Abdomen with rather distinct gray crossbands 22
 Abdomen nearly all subshining brown to black with
 only a very narrow line of gray across apices of
 terga. Maui, Molokai. **planifemorata** n. sp.
- 22(21). Females not differentiable. Oahu.
 **pallidibasis** Malloch.
 Hawaii n. sp.? **pallidibasis**-like #A.
 Lanai. **lanaiensis** n. sp.
- 23(10). Palpi capitate in both sexes (fig. 107b), all black in
 female, yellow-white at apices in male. Hind
 femur of male with dense, fine, black hair over
 ventral surface on basal three-fifths (fig. 107c).
 Anteroventral bristle of hind tibia of male small,
 extending three-fifths the distance to apex of tibia.
 Kauai. **hirtifemur** Malloch.

- Not as above, palpi gradually enlarged toward apices, clavate 24
- 24(23). Thorax black in ground color, or at least mesonotum and sternopleuron predominantly or entirely black if color is obscured by dense pollen (ref. **xenina** n. sp. and **pollinosa** [Grims.] from Maui, Molokai) 25
- Thorax yellow in ground color, except for a longitudinal brown to black vitta between dorsocentral rows; or sides of mesonotum broadly yellow also scutellum yellow. Hawaii **univittata** n. sp.
- 25(24). Front tarsi of males flattened dorsoventrally, equal or broader than front tibiae (figs. 105, 109b) 26
- Front tarsi normal, narrower than tibiae 28
- 26(25). Femora yellow, except for black apices of hind legs in **latitarsis** n. sp. Posterior surface of front tibia not with unusually long, curved hairs and front basitarsus lacking a row of long, posterior hairs; all tarsomeres flattened 27
- Front femur blackened on apical two-thirds and mid and hind femora black at apices. Posterior surface of front tibia with numerous long, curved hairs on apical three-fifths and ventral surface densely black pilose. Only basitarsus and second tarsomere flattened, the former with long hairs along posterior edge (fig. 105). Hawaii
- **dilatata** Malloch.
- 27(26). Femora yellow. Front basitarsus less than half as long as tibia and posterior bristle of front tibia extending about three-fourths to apex of segment (fig. 109b). Posterior bristle of middle tibia extending about one-third the distance to apex. Third tergum with a large triangular black mark in middle. Lanai **latimana** (Grimshaw).
- Hind femora broadly blackened at apices. Front basitarsus slightly over half as long as tibia and posterior bristle of front tibia extends to about apex of segment. Posterior bristle of middle tibia extends over half-way to apex. First three terga of male entirely yellow. Oahu **latitarsis** n. sp.
- 28(25). Abdomen entirely yellow in ground color, except for a faint tinge of brown on sides of terga 4-5 (visible only when wet with 70 percent alcohol). Median

- posterior bristle of front tibia extending to about apex of segment in both sexes. Thorax and abdomen densely golden-yellow pollinose. Sides of mesonotum, humeri, scutellum, and most of pleura yellow in ground color. Female genitalia as in figure 111a. Maui **pollinosa** Malloch.
- Not as above, abdomen with brown to black markings, the coloring of the thorax may be as above in some specimens of **valida** (Grimshaw). Median posterior bristle of front tibia of males much shorter, extending to apex in some females 29
- 29(28). Frontal orbits entirely gray pollinose, all the way to the vertical bristles 30
- Orbits polished black on upper portion between lower superior fronto-orbitals and vertical bristles. Ventral bristle on hind tibia of male short and straight, not extending to apex of segment. Oahu **seminitida** Malloch.
- 30(29). Front tarsi elongate, basitarsus $2/3-3/4$ as long as tibia and first two tarsomeres about equal in length to tibia. Tibia and tarsus, combined, nearly as long as entire body. Mid and hind femora brown to black at apices. Median portion of mesonotum mostly shining brown to black in females and with three rather distinct longitudinal vittae in both sexes. Female abdomen mostly black and male abdomen mostly pale yellow. Male with a rather short, straight, ventral or anteroventral bristle on hind tibia reaching about two-thirds to apex of tibia 31
- Front tarsi comparatively short, basitarsus scarcely over half as long as tibia, the first two combined about three-fourths as long as tibia. Tibia and tarsus combined just slightly longer than head and thorax. Legs mostly yellow; mid and hind femora brown to black in **difficilis** n. sp. Rather densely gray pollinose species 34
- 31(30). Males 32
- Females 33
- 32(31). Aedeagus large, heavily sclerotized, dark brown, rather strap-like (fig. 110b). Hawaii, Maui, Molokai, Lanai **longipes** (Grimshaw).
(**orbitalis** Malloch = synonym)

- Aedeagus weakly sclerotized, hyaline, shaped as in figure 106. Maui **flaccida** n. sp.
- 33(31). Wings nearly hyaline. Oahu **seminitida** Malloch?
Wings mostly brown to blackish. Hawaii, Maui, Molokai, Lanai **longipes** (Grimshaw).
also probably **flaccida** n. sp.
- 34(30). Terga 3-5 broadly blackened posteromedianly, with no paired spots as seen in direct dorsal view.
Mesonotum vittate in females 35
Terga 3-4 or 4-5 with large, clearly defined, paired, opaque brown to black spots, distinctly separated by gray. Mesonotum of both sexes densely pollinose, not vittate 36
- 35(34). Basal portion of arista plumose, the longest hairs being nearly equal in length to width of third antennal segment. Lower front rufous. Ocellar triangle densely gray pollinose and extending well beyond lower superior fronto-orbital bristles
. **dexioides** (Grimshaw).
Arista pubescent basally. Front velvety black. Ocellar triangle rather thinly pollinose, shining below median ocellus and usually ending before lower superior fronto-orbitals. Oahu. (female runs here) **difficilis** n. sp.
- 36(34). Femora all yellow. Thorax yellow-gray pollinose. Maui, Molokai, and Hawaii 37
Hind femora brown at apices. Thorax silvery gray. Surstylus of male nearly three times wider at apex than at base (fig. 104a). Oahu. (only male)
. **difficilis** n. sp.
- 37(36). Antennae all yellow 38
Third antennal segment mostly brown to black. Terminal segments of female abdomen as in figures 101a,b. Hawaii (only female known)
. **biseta** (Grimshaw).
- 38(37). Interfrontal area rather strongly narrowed above, at level of lower superior fronto-orbitals about equal in width to parafrontals (fig. 102b). Male surstylus pointed at apex below (fig. 102c). Seventh tergum and 7 + 8 sternum of female short and broad as in figure 102a. Hawaii
. **brachydexioides** n. sp.
Interfrontal area not so narrowed, at level of lower

- superior fronto-orbitals two times wider than parafrontals (fig. 113a). Surstylus rounded at apex (fig. 113b) and terminal sclerites of female abdomen more elongate as in *biseta* (fig. 101a). Maui, Molokai **valida** (Grimshaw).
- 39(9). Antennae and legs, except for farsi, yellow 40
 Antennae black and at least mid and hind femora broadly brown to black at apices, or legs chiefly, or entirely dark colored. 42
- 40(39). Sides of basal segments of abdomen broadly yellow . . . 41
 Abdomen entirely shining black as seen in direct dorsal view, first and second terga narrowly yellow on lateral margins. Maui (female only). **subseminigra** n. sp.
- 41(40). Interfrontal area yellowish to orange. Aristae long haired, the longest hairs about equal to width of third antennal segment. Humeri black in ground color. Third tergum of abdomen mostly black. Fifth sternum of male with a prominent pointed lobe at apex (fig. 117b). Hawaii **seminigra** (Grimshaw).
 (**plumiseta** Malloch = synonym)
 Interfrontal area brown in ground color, gray pollinose. Aristae short plumose, the hairs are much less than width of third segment. Humeri mostly yellow in ground color. Third tergum nearly all yellow. Oahu. (female runs here). **oahuae** Malloch.
- 42(39). Base of third antennal segment yellow to orange, tibiae yellow; femora yellow basally and front pair may be largely or entirely yellow. 43
 Antennae all black, legs mostly or entirely black or dark colored. 44
- 43(42). Aristae pubescent. All femora yellow at bases and apices, broadly brown, covered with gray pollen medianly. Mesonotum gray-brown pollinose. Abdomen brown pollinose. Ocellar triangle long, extending to level with upper inferior fronto-orbital bristles. Maui. n. sp. 'A' **seminigra** complex.
 Arista plumose. Mid and hind femora shining black except for narrow bases, and very narrow apices of mid; front femora yellow, tinged with brown medianly. Mesonotum subshining black over

- dorsum, gray on margins. Abdomen shining black. Ocellar triangle ending about opposite lower superior fronto-orbitals. Hawaii
 n. sp. 'B' **seminigra** complex.
- 44(42). Palpi yellow. Calypters yellowish, rims tinged with brown in **xenina** Malloch. Vibrissae normal, not consisting of a row of strong bristles 45
 Palpi black. Calypters with rims dark brown to blackish. Only one anteroventral bristle on hind tibia. No anterior bristle in middle of mid tibia. Oral vibrissae strong (fig. 115d). Completely black species. Maui **melanoxenia** n. sp.
- 45(44). Mid tibia with a strong anterodorsal bristle at apical third. Only one preapical dorsal bristle on hind femur. Mesonotum and most of abdomen subshining brown to black, lightly brownish pollinose. Hawaii (only female known)
 **xenina** Malloch.
 No anterodorsal bristle on mid tibia. Hind femur with two preapical dorsals. Mesonotum brown pollinose with faint gray vittae. Abdomen gray pollinose with brown marks in middle of terga. Maui n. sp. 'A' female **xenina** complex.
- 46(8). Front and middle femora or mid and hind with numerous short, stout, black ventral spines (fig. 77a), often more abundant on mid femora. Brevispina group of species and females of atratipes subgroup 47
 Femora lacking stout ventral spines . . . alakaiae group and males of atratipes subgroup 63
- 47(46). Legs predominantly or entirely black, at least femora all dark reddish brown to black 48
 Legs mostly yellow, or at least basal portions of femora broadly yellow to rufous 55
- 48(47). No anteroventral bristles on hind tibia 49
 With one prominent anteroventral or anterior bristle near middle on hind tibia 51
- 49(48). Palpi black, calypters white. Hind femur with one preapical dorsal bristle in addition to the preapical postero- and antero-dorsal bristles 50
 Palpi yellow, calypters yellow-brown. Scutellum gray medianly, brown on sides. Preapical dorsal bristle lacking on hind femur. Male genitalia as in

- figure 75a and with a dense brush of black bristles on sides of fifth sternum (figs. 75b,c). Maui.
 **brunnidorsata** n. sp.
- 50(49). Mesonotum entirely brown, no gray markings. Abdomen black, gray pollinose at apices of terga and lacking paired spots. Oahu **kaalae** Williams.
 Mesonotum gray with brown vittae. Abdomen gray pollinose with large subopaque paired spots on terga. (One female from Molokai [aberrant?] runs here which has no anteroventral bristle on hind tibia.) **ocellata** n. sp.
- 51(48). Calypters white, slightly yellowish on specimens from Hawaii. Palpi black, at least at apices 52
 Calypters yellow-brown. Palpi yellowish. (Only female known). Maui, Hawaii **badia** n. sp.
- 52(51). Abdomen gray, with large conspicuous paired black spots on terga 53
 Abdomen brown with narrow gray apices on terga. Mesonotum brown pollinose, not vittate. Maui. (Only female known) **caliginosa** n. sp.
- 53(52). Abdomen all black 54
 Sides of first two terga yellow. Kauai (Female runs here, male keys in couplet 72). **comparata** n. sp.
- 54(53). Mesonotum typically gray with brown vittae; scutellum usually gray medianly. Maui, Molokai, and Lanai. (Female only, male keys at couplet 72) **ocellata** n. sp.
 Mesonotum typically brown with faint gray vittae and scutellum usually brown on disc, gray on margin. Hawaii. (Female only, male keys at couplet 103; female of *comata* n. sp. may also key here). **atratypes** Malloch.
- 55(47). Hind tibia with a prominent anteroventral bristle on apical three-fifths 56
 Anteroventral bristle lacking on hind tibia 60
- 56(55). Abdomen with paired brown to black spots on most of the terga. Femora all yellow, except in female of **eximia** n. sp. 57
 Abdomen lacking paired spots. Mid and hind femora broadly brown to black at apices. Female runs here. Molokai **dispar** (Grimshaw).

- 57(56). Hind femur with one preapical dorsal bristle, in addition to a posterodorsal. Mesonotum with three brown vittae. 58
 Preapical dorsals lacking on hind femur (a bristle is present between dorsal and posterodorsal areas but this is interpreted as a slightly displaced posterodorsal). Mesonotum not vittate 59
- 58(57). Only one intraalar bristle. Femora all yellow. Third antennal segment broadly yellow at base. Ocellar triangle extending nearly to lunule. Maui. (Only female known) **brevispina** Malloch.
 Two strong intraalars. Mid and hind femur broadly brownish at apex. Third antennal segment entirely black. Ocellar triangle extends to about level with upper inferior fronto-orbital. Hawaii. (Only female runs here) **eximia** n. sp.
- 59(57). Middle femur densely spinulose on ventral surface (fig. 77a), and mid tibia densely covered with erect setae ventrally. One anteroventral bristle on hind tibia. Aristae plumose. Two intraalar bristles present. Fifth sternum not densely bristled (fig. 77b) and surstyli very large (fig. 77c). Maui. (Only male known) **haleakalae** n. sp.
 By comparison the mid femora are rather sparsely spinulose and the tibiae lack erect ventral setae. No anteroventrals on hind tibia. Aristae pubescent. Only one intraalar bristle. Fifth sternum densely bristled (fig. 78b). Surstyli very slender and extension from cercus strongly curved (fig. 78a). Hawaii. (Only male known).
 **hualalaiae** n. sp.
- 60(55). Femora all yellow. Mesonotum not chocolate brown with prominent gray spots 61
 Front femora mostly black over dorsum and on sides, yellow to rufous on venter and apices and bases. Mid and hind femora broadly blackened at apices. Mesonotum mostly chocolate brown with a pair of submedian, prominent, gray presutural vittae and a pair of elongate, gray postsutural spots (fig. 83). Hawaii. (Female only)
 **sigillata** n. sp.
- 61(60). Two strong intraalar bristles. Mesonotum and scutellum mostly gray or yellow-gray pollinose.

- Eye orbits gray to yellow-gray. Abdomen mostly gray to yellow-gray with brown to black markings . . 62
 Only one intraalar bristle. Mesonotum, scutellum, eye orbits, and abdomen mostly brown pollinose. The former with short, gray vittae (indistinct in female) anteriorly and the latter with narrow grayish apices on terga. Maui, Molokai.
 **longisetosa** n. sp.
- 62(61). Third antennal segment mostly black, rufous only at base. Process of male cerci with a pair of strong recurved spines apically. Genitalia as in figures 80a,b. Maui, Molokai, and Hawaii
 **mauiensis** n. sp.
- Antennae entirely rufous. Thorax densely yellow-gray pollinose, no indication of vittae. Abdomen yellow-gray with a pair of brown spots on terga 3 and 4 and indistinct median brown vittae. Male genitalia not as above. Maui **mimetica** n. sp.
- 63(46). Male and female middle tibiae with one, or two, strong posterior bristles near middle or with a row of very strong posterodorsal bristles (fig. 47a) 64
 Male median posterior bristles lacking on mid tibiae. Only one preapical posterior bristle on hind femur. Small species, body 3.2-3.5 mm. Fifth sternum U-shaped on hind margin, with entire margin densely yellow pilose and pubescent. Genitalia as in figure 41c. Oahu
 **inconstans** Malloch.
 (Female keys in couplet 78 by having posterior bristle on mid tibia.)
- 64(63). Hind femur with two bristles at apical 1/4-1/5 in approximately a dorsal position but with no anterodorsals (fig. 53d). Fifth sternum of male wider than long with a broad V-shaped cleft on hind margin (fig. 53c). Surstyli strongly arched (fig. 53a). Anteroventral bristle of front tibia situated near apical 1/4 of segment. Kohala Mountains, Hawaii. **swezeyi** n. sp.
 Not as above 65
- 65(64). No preapical dorsal bristles on hind femora and with the usual preapical antero and posterodorsals; or if one slightly off center dorsal is present (fig.

- 38c), the posterodorsals are absent . . . *alakaiae* subgroup and some males of *atratypes* group 66
- One or more prominent preapical dorsal bristles on hind femora near apical 1/5 in addition to antero and posterodorsals (fig. 58d) . . . *confluens* subgroup and some males of *atratypes* group 95
- 66(65). Legs mostly or entirely black or dark reddish brown to black 67
- At least bases of mid and hind femora broadly yellow to rufous 77
- 67(66). Rows of strong bristles lacking on mid and hind tibiae. Fifth sternum of male lacking a pecten of stout bristles on margin 68
- Male, female hind tibia with five strong anterodorsal bristles and a complete row of small posterodorsals. Mid tibia with a row of very strong posterodorsal bristles (fig. 47a). The longest are 4/5 as long as tibia. Fifth sternum of male with a prominent pecten on each side formed by thick bristles (fig. 47c,d). Maui. ***pectinata*** n. sp.
- 68(67). Palpi black or fuscous, at least on apical halves 69
- Palpi yellow to rufous. 73
- 69(68). Hind tibia with one or two anteroventral bristles near middle 70
- Anteroventrals lacking on hind tibiae. Abdomen brown with broad gray-white apices on terga 2-4. Mesonotum brown. Oahu. Some males may run here. *kaalae* species complex (females run in *brevispina* group) (refer to couplet 99)
- 70(69). Mid tibia with one median posterior bristle and no anteriors near middle. Hind tibia with only one anteroventral bristle 71
- Mid tibia with two posterior and one anterior bristle in median portion (fig. 85c). Hind tibia with two anteroventrals. Abdomen lacking paired black spots. Male genitalia as in figure 85a, surstyli rudimentary. Hawaii. ***ascita*** n. sp.
- 71(70). Abdomen with large, subshining, paired black spots on terga. Calypters white. Surstyli of male absent . . 72
- Terga lacking paired spots. Calypters with brown rims. Anterodorsal bristle at middle of hind tibia elongate, over half the length of tibia. Oahu. (Only female known) ***fuscofacies*** Malloch.

- 72(71). Fifth sternum of male with a prominent lobe on inner apical margin (readily seen *in situ*). Abdomen with large, opaque, paired black spots on terga 2-5. Surstyli not developed (fig. 92c). (Males run here) Molokai, Maui, Lanai **ocellata** n. sp.
Fifth sternum broadly rounded apically, not lobate. Paired black spots on terga 3-5. Surstyli represented by small triangular lobes (fig. 89a). (Males run here) Kauai **comparata** n. sp.
- 73(68). Calypters white, rims faintly yellowish 74
Calypters dark fumose, rims brown 75
- 74(73). Femora all black. Abdominal terga 3 and 5 with paired black spots. Male genitalia as in figure 38a. Surstyli not parallel-sided. Extension from cercus with short, stout, ventral teeth at apex. Maui, Molokai **dentata** n. sp.
Femora yellow at bases. Terga lacking spots. Male genitalia as in figure 44a. Surstyli slender, straight-sided. Cercus not as above. Kauai
. **leptostylata** n. sp.
- 75(73). Parafacials brown pollinose, contrasting from gray-white face. Preapical dorsal bristle of hind tibia rather long, longer than basitarsus and one-third as long as tibia. Humeri, pleura, and first abdominal tergum dull grayish, not sharply contrasting from mesonotum. Front basitarsi of male about one-half as long as tibia. Fifth sternum of male not bilobed; genitalia as in figures 46b and 51a 76
Parafacials gray-white pollinose, concolorous with face. Preapical dorsal bristle of hind tibia short, much shorter than basitarsus and less than one-fourth tibia. Humeri, pleura, and first tergum densely gray-white pollinose, contrasting from brown mesonotum. Male basitarsi two-thirds as long as tibiae. Fifth sternum of male indistinctly bilobed at apex (fig. 49b,c); genitalia as in figure 49a **philydra** n. sp.
- 76(75). Surstylus of male boomerang-shaped, expanded at base and at apex (fig. 46a). Fifth sternum widely V-shaped on hind margin (fig. 46b). Molokai **parydra** n. sp.
Surstyli narrowed basally, strongly arched on dorsal

- margin (fig. 51a). Fifth sternum shaped as in figure 51b. Maui **silvicola** n. sp.
- 77(66). Hind femur (males) with a dense clump of long, black posterior hairs extending from about middle to apical fourth (fig. 114c). No posteroventral or preapical dorsal bristles on hind femora. Thorax, abdomen, parafrontals, and face densely golden-yellow pollinose, completely obscuring the ground color. Ground color of abdomen almost all yellow. Hawaii. (Only male known). **villosifemora** n. sp.
- Not as above 78
- 78(77). Hind tibia with one or more anteroventral bristles in both sexes. Mid femur with two to three preapical posterior, or posterodorsal, bristles 79
- Females, hind tibia lacking anteroventrals. Mid femur with only one preapical posterior bristle. Posterior bristle of mid tibia near basal third of segment. Small, dull gray species, body 3.5 mm. Oahu. (Males key at couplet 63) **inconstans** Malloch.
- 79(78). Thorax black in ground color 80
- Thorax yellow except for brownish red tinge on mesonotum between dorsocentral rows and with brown on sides of scutellum. Only one pair presutural dorsocentrals. Molokai **perflava** n. sp.
- 80(79). Hind tibia with a prominent pair of bristles, posterodorsal, and anterodorsals basad of long median pair (fig. 76d); preapical dorsal bristle of hind tibia nearly half as long as segment 81
- Hind tibia lacking bristles basad of median posterodorsals and anterodorsals, preapical dorsal bristle about one-third as long as tibia (fig. 52b). Legs slender, front basitarsus about two-thirds as long as tibia. Oahu **striata** (Grimshaw).
- 81(80). At least apices of hind femora brown. 82
- Legs entirely yellowish except for brown tarsi, or rarely with a tinge of brown medianly on femora and with apices pale 90
- 82(81). Basal segments of abdomen broadly yellow on sides, often first two-three terga mostly yellow. Parafrontals white or yellow-white 83
- Abdomen entirely black in ground color, evenly

- gray to brownish pollinose. Parafrontals and upper parafacials brown pollinose. All femora broadly brown to black apically, yellow on bases and often on venter. Calypters tinged with brown, especially on rims 86
- 83(82). Not more than apices of femora black. Palpi yellow . . . 84
 Apical two-thirds of femora black. Palpi mostly dark brown. Male genitalia as in figures 42a-c. Kauai **incompta** n. sp.
- 84(83). Males and females. Only hind femora brown to blackish at apices. Male genitalia as in figures 37a-c, 55a-d. 85
 Males. Mid and hind femora broadly blackish at apices and front femora dark brown dorsally, near apices. (Females fitting into brevispina group by having short, ventral spinules on front and middle femora.) Molokai. . . . **dispar** (Grimshaw).
- 85(84). Fifth sternum of male with a small basal lobe as seen in lateral view (fig. 55c). Extension from cercus short and thick, with numerous spicules over basal portion. Parameres short, thick, strongly curved, hook-like (fig. 55a). Maui **whittlei** n. sp.
 Fifth sternum not with basal lobe. Extension from cercus slender, curved upward, flattened, and setose medioventrally, and lacking spicules basally. Surstyli straight, setose apically. Parameres slender, gently curved (fig. 37c). Maui **deceptiva** n. sp.
- 86(82). Females. Frontal triangle large, extending nearly to lunule. Dorsum of thorax and abdomen subshining black. Hawaii . . . n. sp.? female 'A' *intonsa*-like
 Males and females, not as above. Maui and Oahu. . . . 87
- 87(86). Front basitarsus about half as long as tibia. Fifth sternum of male not with dense black setae on margin (fig. 39b) and genitalia as in figures 35a, 39a, 48a. 88
 Front basitarsus slender, nearly two-thirds as long as tibia. Fifth sternum of male densely black setose (fig. 43a) and genitalia as in figure 43b. Maui **intonsa** n. sp.
- 88(87). Fifth sternum of male rounded at apex as seen in lateral view. Extension from cercus rather abrupt-

- ly tapered apically and surstyli not curved downward (figs. 35b, 48a). Larger, mostly opaque brown to blackish species, body 6.0–6.5 mm 89
- Fifth sternum truncate apically, as seen in side view.
Extension from cercus gradually tapered and surstyli curved downward (fig. 39a). Smaller, mostly grayish pollinose, body 4.25–5.0 mm. Oahu
. **fusca** Malloch.
- 89(88). Fifth sternum elongate, about one-half longer than wide; the lobes are rather broad apically (fig. 35a). Surstylus curved upward and parameres not spiculated (fig. 35b). Maui **aquila** n. sp.
- Fifth sternum about as wide as long, the lobes gently tapered apically (fig. 48b). Surstyli not curved upward and posterior parameres (postgonites) densely spinulose on underside (fig. 48a). Maui
. **penaquila** n. sp.
- 90(81). Antennae mostly or entirely brown to black 91
- Antennae rufous with a tinge of brown on upper portion of third segment, the ocellar triangle elongate, extending nearly to anterior margin of front. Oahu. (Only female known)
. **crassifemur** Malloch.
- 91(90). Abdomen gray pollinose with subshining brown or black paired spots on at least terga 4 and 5, as seen in strong light from end view. Mesonotum sometimes vittate 92
- Abdomen lacking paired spots. Mesonotum brown pollinose, not vittate. Male fifth sternum and genitalia as in figures 36a,b. Maui **aspilota** n. sp.
- 92(91). Abdomen yellow on sides of first two terga. Frontal triangle rather short, extending about half the length of front, usually to level about opposite lower superior fronto-orbitals. Mesonotum usually with at least faint brown vittae 93
- Abdomen entirely black in ground color. Frontal triangle rather long, extending to or beyond level with upper inferior fronto-orbitals. No brown marking or vittae on mesonotum. Fifth sternum of male and genitalia as in figures 50a,c. Maui
. **rudis** (Grimshaw).
- 93(92). Front basitarsus of male elongate, over half as long as tibia, and the latter only slightly longer than

- first two tarsomeres. Front tarsi brown setose and pilose ventrally. Fifth sternum and male genitalia as in figures 34a,b, 40a,b, 45a,b 94
- Front basitarsus of male short, about two-fifths as long as tibia and the latter equal in length to about four tarsomeres. Front tarsi densely yellow-white pilose on venter with few brown setae intermixed. Process from male cercus with abundant spicules in middle above and lacking ventral spicules or setae (fig. 40a). Oahu **fusciseta** Malloch.
- 94(93). Both sexes with prominent, shining, paired spots on terga three to five. Male surstyli broad, extension from cercus with strong preapical ventral teeth, other genital characters as in figure 45b. Face golden gray **molokaienses** n. sp.
- No distinct paired spots on terga, first three terga of male mostly yellow. Extension from cercus lacking strong teeth. Male surstyli slender. Other details of genitalia as in figure 34a. Face gray. Kauai **alakaiae** n. sp.
- 95(65). Middle tibia with two posterior bristles and one anterior bristle in median portion. Arista conspicuously long plumose, the hairs equal to or longer than width of third segment. Fifth sternum of male extended into a small, pointed lobe at apex (figs. 117e,f). Antennae and legs yellow. Abdomen lacking paired spots on terga. Hawaii. (Some males may lack the posterior bristle on front tibia and would run here.) **seminigra** (Grimshaw).
- (**plumiseta** Malloch is a synonym)
- Not fitting above. Middle tibia with only one posterior bristle and no anterior, except rarely for a tiny bristle at apical three-fourths to four-fifths. Arista not so long plumose and fifth sternum not with a pointed apical lobe 96
- 96(95). Femora dark colored brown to black, sometimes tinged with rufous and tibiae often tinged brown to black 97
- Femora mostly yellow to rufous 108
- 97(96). Palpi brown to blackish at least on apical halves 98
- Palpi all yellow. 104

- 98(97). Males, females. Hind tibia with one or more anteroventral bristles. Abdominal terga with paired dark-brown to black spots, at least as seen in end view. 102
 Males (females run in couplet 50). Hind tibiae lacking anteroventrals. Abdominal terga brown pollinose with gray apices and with no paired spots . . . *argentifrons* subgroup 99
- 99(98). Oahu *kaalae* Williams.
 Occurring on other islands 100
- 100(99). Hawaii (males not known but probably will fit here) *kaalae* complex n. sp. 'A'.
 Kauai, Maui, or Molokai 101
- 101(100). Front, as well as face, entirely silvery. Mesonotum silvery gray with the posteromedian portion, bounded by the postsutural dorsocentrals, brown pollinose, and with a narrow brown presutural vitta in each dorsocentral row. Process from male cercus strongly capitate as seen from end view (fig. 84b). A dense patch of short, black bristles present on each lobe of fifth sternum (fig. 84a). Maui, and probably Molokai *argentifrons* n. sp.
 Vertex, ocellar triangle, and parafrontalia dark brown, except for narrow line of gray along orbits; interfrontalia opaque black. Mesonotum brown pollinose, except for gray margins. Extension of cercus not enlarged, bent slightly downward at apex. Fifth sternum with scattered hairs but no stout bristles (fig. 87b). Kauai
 *brunneifrons* n. sp.
- 102(98). Only one anteroventral bristle on hind tibia. Calypters white. Frontal triangle extends slightly beyond middle of front. Abdomen with large, conspicuous, paired black spots on most of terga. 103
 Almost always three anteroventral bristles on hind tibia, rarely two. Rims of calypters brown. Paired spots on terga rather indistinct. Frontal triangle extends nearly to anterior margin of front. Hawaii, possibly Maui. *fuscobrunnea* Malloch.
- 103(102). Palpi all black. Fifth sternum of male with a prominent incurved rounded lobe on each inner apical margin (readily seen *in situ*) (fig. 86b). Meso-

- notum brown with faint gray vittae. Scutellum brown on disc, gray on sides. Male lacking surstyli (fig. 86a). Hawaii. (Males run here)
 **atratiipes** Malloch.
 Only apices of palpi fuscous. Fifth sternum broadly rounded, not lobate at apices (fig. 89b). Mesonotum gray with brown vittae. Scutellum gray in middle, brown on sides. Surstyli small (fig. 89a). Hawaii. (Males run here) **comata** n. sp.
- 104(97). Calypters white or but slightly yellow on rims. Frontal triangle extended as a sharp point nearly to anterior margin of front 105
 Calypters dark fumose, rims brown. Wings brown. Frontal triangle short, extending to about upper pair of inferior fronto-orbitals. Male genitalia as in figure 56b. Surstyli very slender, straight-sided. Hawaii **brunneipennis** n. sp.
- 105(104). Hind tibia with one anteroventral and hind femur with one preapical dorsal bristle. Abdomen grayish pollinose, with paired black spots on terga . . . 106
 Hind tibia with two or three anteroventrals and femur with two or three preapical dorsals. Abdomen subshining black, lightly gray-brown pollinose, and lacking paired spots on terga. Maui, Molokai. **parilis** n. sp.
- 106(105). Aristae short pubescent or nearly bare. Wings tinged with brown. Abdomen mostly black in ground color. 107
 Aristae short plumose. Wings hyaline. First three abdominal segments and base of fourth nearly all yellow. Small species, body 3.75 mm. Male surstyli rudimentary (fig. 93a). Kauai. **parva** n. sp.
- 107(106). Tibiae mostly yellow to rufous, mesonotum gray with distinct brown vittae. Body 6.0–7.0 mm. Molokai **rufibasis** Malloch.
 Tibiae dark brown to black. Mesonotum mostly brown pollinose, not vittate. Smaller species, body 4.5 mm. Oahu **implumis** n. sp.
- 108(96). Hind tibia with three or four anteroventrals 109
 Hind tibia with one or two anteroventrals 114
- 109(108). Two prominent intraalar bristles 110
 Only one intraalar bristle. Hawaii (some specimens may run here) **subvittata** Malloch.

- 110(109). Hind tibiae broadly brown to blackish at apices.
 Mesonotum with brown pollinose vittae or markings 111
 Legs all yellow except for brown apical tarsomeres.
 Mesonotum densely yellow-gray or gray pollinose, lacking brown markings. 113
- 111(110). Antennae mostly black. Extension from male cercus not bent downward. Specimens not from Kauai. . . 112
 Antennae rufous. Extension from cercus bent downward apically (fig. 61a). Kauai **flexa** n. sp.
- 112(111). Ventral setae at middle of extension of male cercus well separated from preapical ventral spinules and parameres broad (fig. 58a). Maui, Molokai **confluens** Malloch.
 Ventral setae confluent with preapical spinules and parameres narrow (fig. 72a). Hawaii (some specimens may run here). **triangulifera** (Grimshaw).
- 113(110). Thorax yellowish pollinose, yellow in ground color of humeri, pleura, and on scutellum. Fifth sternum of male as in figure 68b. Oahu, Molokai, Maui, and possibly Kauai (some specimens may run here) **paloloae** Malloch.
 Thorax gray pollinose and entirely black in ground color. Fifth sternum as in figure 64b. Maui, Molokai, Lanai, and Hawaii (some specimens may run here) **indecisa** n. sp.
- 114(108). Pleura, scutellum, humeri, and at least sides of mesonotum conspicuously yellow, with ground color not obscured by gray pollen 115
 Thorax entirely black in ground color or if brownish-yellow on pleura and hind margin and venter of scutellum (**paloloae** Malloch), the ground color is obscured by dense gray pollen . . . 116
- 115(114). Legs entirely yellow. Front yellow, at least on lower part; eye margins on front parallel. Pleura all yellow, mesonotum mostly black, yellow on margins. Male genitalia as in figure 73a. Maui. **xanthopleura** n. sp.
 Apices of hind femora brown. Front brownish-red; eye margins distinctly converging anteriorly. A small brown spot present on upper portion of pteropleuron, and mesonotum brown only on posteromedian portion. Male genitalia as in figure 66a. Kauai **montgomeryi** n. sp.

- 116(114). Antennae and bases of aristae all yellow. If third is slightly tinged with brown dorsoapically on female, the hind femur has two preapical dorsals and the hind tibia with one anteroventral. 117
 At least third antennal segment mostly brown to black 120
- 117(116). Anterior pair of postsutural dorsocentrals strong, about equal in size to second presutural dorsocentrals. Crossvein r-m at middle of cell 1st M_2 and last section of vein $M_1 + 2$ less than two times longer than penultimate section; the proportions ca. 4.1 to 2.6. Process from male cercus not curved upward at apex (figs. 60a, 70a) 118
 Anterior pair of postsutural dorsocentrals weak, equal in size to anterior dorsocentrals, and scarcely larger than anterior acrostichals. Crossvein r-m beyond middle of cell 1st M_2 and last section of $M_1 + 2$ nearly three times longer than penultimate section; the proportions ca. 5.9 to 2.3. Processes from cercus and surstyli both strongly curved upward at apices (fig. 116a). Oahu. (Males run here) **oahuae** Malloch.
- 118(117). Lobes of fifth sternum of male each with a row of about 15 black hairs or bristles (fig. 60b) 119
 Lobes of fifth with 5-6 bristle-like hairs (fig. 70b), plus a few small setae. Male surstyli slender, narrowed basally (fig. 70a). Oahu **pauciseta** n. sp.
- 119(118). Hind femora brown to black at apices. Hawaii
 **flavobasalis** (Grimshaw).
 Hind femora all yellow. Maui, Molokai
 **flavobasalis extera** n. subsp.
- 120(116). Legs entirely yellow except for brownish tarsi. Mentum yellow. Mesonotum densely yellow-gray pollinose, no brown markings 121
 At least hind femora broadly brown to black at apices or femora brown to blackish medianly. Mesonotum with brown vittae, median portion brown, or predominantly brown, except in **kauaiensis** (Grimshaw). Mentum usually dark colored. 122
- 121(120). Humeri, pleura, and hind margin and venter of scutellum yellow, tinged with brown in ground color. Thorax usually grayish yellow pollinose. Fifth sternum of male scarcely longer than wide;

the concavity on hind margin extending about half the length of sclerite (fig. 68b). Oahu, Molokai, Maui, and possibly Kauai **paloloae** Malloch.

Thorax all black in ground color and densely gray pollinose. Fifth sternum distinctly longer than wide with the concavity extending about one-third to two-fifths its length (fig. 64b). Maui, Molokai, Lanai, and Hawaii **indecisa** n. sp.

122(120). Mesonotum marked with brown or entirely brown. Two pairs presutural dorsocentrals. Species not from Kauai 123

Mesonotum entirely gray pollinose, no brown markings, only one pair of presutural dorsocentrals. Kauai **kauaiensis** (Grimshaw).

123(122). Mesonotum gray, with brown vittae or median portion brown pollinose, with sides broadly gray. Ocellar triangle extending nearly to anterior margin of front. Two preapical dorsal bristles on hind femur. Abdomen with subshining brown to black, or large, opaque black, paired spots on terga 3-5, except in *carita* n. sp. 124

Dorsum of thorax dark, subshining brown except for gray on anterior corners and on sides of suture. Ocellar triangle very short, extending to about level with lower superior fronto-orbitals. One preapical dorsal on hind femur. Abdomen lacking subshining paired spots on terga. Wings brown. Hawaii. **obscura** n. sp.

124(123). Arista moderately long plumose (except in *carita* n. sp.). Hind and sometimes mid femora brown to blackish at apices. Mid tibia with only a posterior bristle in median portion. Hind margin of fifth sternum not densely bristled (fig. 91a) and surstyli well developed (fig. 59a), or completely lacking (fig. 91b) 125

Arista pubescent. Femora brown to blackish medianly, yellow apically. One preapical dorsal on hind femur and one anteroventral on hind tibia, also a strong anteroventral near apical three-fifths of middle tibia. Hind margin of male fifth sternum densely bristled (fig. 88a). Male surstyli very small, extending but a short distance beyond edge of epandrium (fig. 88b). Maui. **chaetoloma** n. sp.

- 125(124). Two anteroventral bristles on hind tibia and two or three preapical dorsals on hind femur. Paired spots on abdominal terga inconspicuous, except in strong direct light, or lacking in *carita* n. sp. Surstyli well developed (fig. 59a) 126
 One anteroventral on hind tibia and one preapical dorsal on hind femur. Paired spots on terga large and prominent. Surstyli lacking, aedeagus tube-like at apex (fig. 91b). Hawaii. (Males run here) **eximia** n. sp.
- 126(125). Two strong intraalar bristles present 127
 Only one intraalar, the anterior bristle not developed. Hawaii. (Type male) **subvittata** Malloch.
- 127(126). Vertex, ocellar triangle, and parafrontalia gray pollinose. Aristae moderately long plumose. Mesonotum and scutellum mostly gray pollinose. Hind and or mid femora brown to black only on apices. Abdomen with paired, subshining brown markings, as seen in end view, especially on terga 4 and 5. Base of third antennal segment broadly yellow 128
 Vertex, ocellar triangle, and at least inner edge of parafrontalia brown pollinose. Aristae short plumose to pubescent. Mesonotum and scutellum brown pollinose, except for gray margins. Terga 3 to 5 of males and all terga in females mostly dark brown to black, bordered with gray posteriorly and on side, and with no paired spots. Apical three-fifths to two-thirds of hind and one-half of mid femur black. Antennae black. Maui **carita** n. sp.
- 128(127). Small species, body 4.0 mm. Third antennal segment only two times longer than second (the latter measured in dorsal view along longitudinal seam). Lobes of male fifth sternum truncate apically as seen from side (fig. 59b). Extension from male cercus with the median ventral setae widely spaced from preapical ventral spinules and surstyli distinctly bent downward at apices (fig. 59a). Oahu. **expulsa** n. sp.
 Larger species, body 5.0–5.5 mm. Third antennal segment nearly three times longer than second. Lobes of fifth sternum rounded at apices. Median ventral setae on extension from cercus confluent

with preapical ventral spinules and surstyli, nearly straight (fig. 72a). Hawaii.
 **triangulifera** (Grimshaw).

ALAKAIAE GROUP OF SPECIES

Characterized by having four strong scutellar bristles, lacking postero-median bristles on front tibiae and femora not spinose ventrally.

ALAKAIAE SUBGROUP OF SPECIES

No preapical dorsal bristles on hind femora (fig. 52a), or if with a bristle (two in *swezeyi* n. sp., fig. 53d), slightly posterior of the dorsal line no preapical posterodorsal is present (fig. 38c).

Hind tibia typically with a pair each of preapical postero- and anterodorsals and one strong dorsal near apical one-fifth to one-sixth of segment; a pair of strong postero- and anterodorsals at middle and another pair of small postero- and anterodorsals below middle of basal third of segment. *L. striata* (Grimshaw) and *perflava* n. sp. lack the pair of postero- and anterodorsals below middle of segment.

Lispocephala alakaiae Hardy, new species (figs. 34a-c)

Belonging in a complex of species with *fusciseta* Malloch and *molokaiensis* n. sp., it shows closest relationship to the latter but the male genitalia are very different in the two (figs. 34a,b).

MALE. Fitting most of the characteristics of *fusciseta* and related species; the only diagnostic features I see are in the development of the fifth sternum and the genitalia. The front tarsi are comparatively slender, as in *molokaiensis*, with the basitarsus measuring approximately three-fifths as long as tibia and first two tarsomeres approximately equal to length of tibia. Mesonotum mostly brownish-gray with only faint indication of vittae. First three terga of abdomen yellow except for rather faint brown vitta down median portion. Terga four and five mostly black in ground color, gray pollinose with only faint indications of paired subshining spots. Sides of fourth tergum rather broadly yellow and often the posterior margin is narrowly yellow. Fifth sternum and genitalia yellow. As seen from lateral view, the fifth sternum has a rounded lobe at apex (fig. 34a); as seen from ventral view it is broadly V-shaped on posterior margin (fig. 34b). The process from the cercus is curved downward toward apex, has a prominent patch of subbasal setae and only minute spicules apically. The surstyli are slender, slightly enlarged apically. The parameres are pointed with a subbasal spine, and a subbasal fringe of flat setae is present on aedeagus (fig. 34a).

Length of body, 4.25 mm.

FEMALE. Fitting description of male except that the abdomen is mostly brown to black over dorsum, yellow on sides of first two terga, with apices of

terga distinct gray to yellow-gray, and with paired subshining spots only on fourth tergum.

Length of body, 4.5 mm.

Holotype male: Alakai Swamp, Kauai, 3,800 ft., July 28, 1963 (D. E. Hardy). Allotype female same locality, 4,000 ft., August 1963 (D. E. Hardy). 108 paratypes, both sexes about evenly distributed, from the high, wet country of Kauai: a large series same data as type and allotype collected July–August 1921–1966 (O. H. Swezey, E. H. Bryan, A. M. Adamson, and D. E. Hardy); Mt. Waialeale Trail, 4,500 ft., August 1953 (D. E. Hardy); Mohihi Ridge, July 1940 (E. H. Bryan, Jr.); Mohihi Stream, July 29, 1963 (D. E. Hardy); Kokee, September 1965 (C. M. Yoshimoto). This species is very common in the Alakai Swamp, Mt. Waialeale area of Kauai.

Type, allotype, and a series of paratypes in B. P. Bishop Museum. Other paratypes in collections of U. S. National Museum, British Museum (Natural History), and the University of Hawaii.

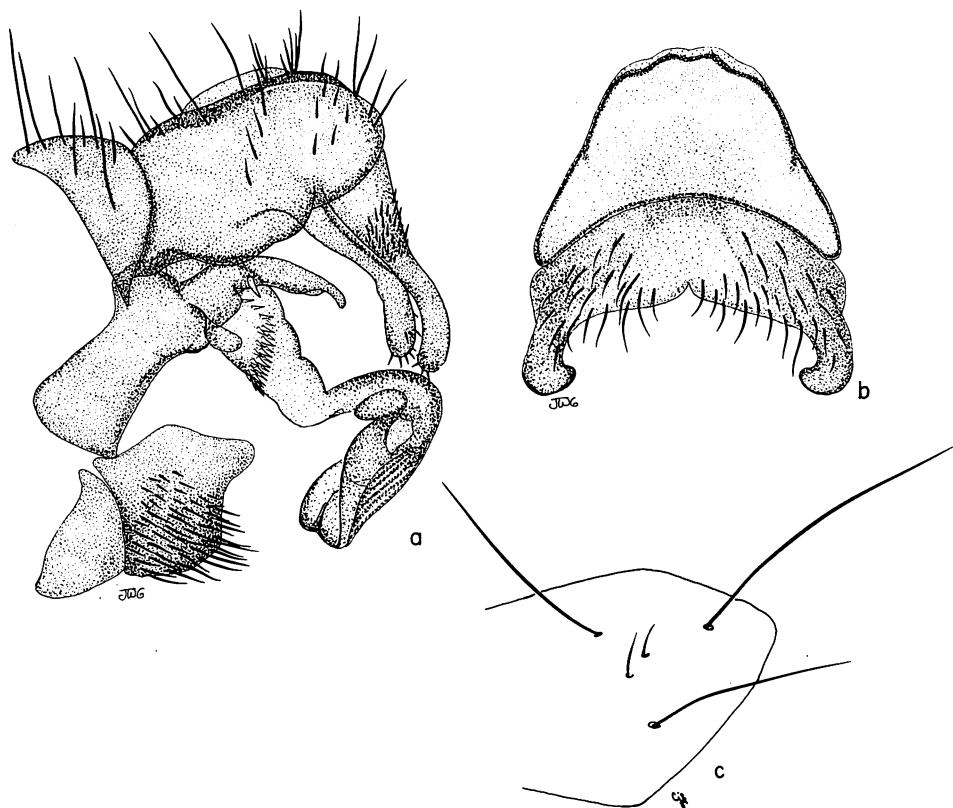


Figure 34—*Lispocephala alakaiae* n. sp.: a, male genitalia, lateral; b, fifth sternum of male; c, arrangement of sternopleural bristles.

***Lispocephala aquila* Hardy, new species (figs. 35a,b)**

Fitting in the *alakaiae* group of species with no preapical dorsals on hind femora, near *fusca* Malloch, from Oahu, by having the abdomen entirely black, the femora blackened at apices, and the calypters brown on the rims. It differs from *fusca* by being larger, mostly dull black, lightly gray-brown pollinose over dorsum of thorax and abdomen; and fifth sternum and genitalia very different in development as shown in figures 35a,b. It is mostly closely related to *penaquila* n. sp. and to *fusca* Malloch and is differentiated by the male genital characters as discussed under those species.

MALE. Head: Wider than high with interfrontalia opaque reddish brown to black. Parafrontalia and ocellar triangle brown pollinose, the latter extending slightly beyond level with lower superior fronto-orbitals. Parafacials light brown pollinose on upper portion, gray below. Face, genae, and occiput white. Back portion of occiput with a faint blue tinge in the pollinosity. Antennae black, arista pubescent on basal portion. Palpi slender, entirely yellow, rather thickly black setose. Mentum polished, dark brown to black, labella yellow-brown. **Thorax:** Gray, with a faint tinge of blue in the pollen of the pleura, brown pollinose on upper hind portion of each mesopleuron. Mesonotum and scutellum gray-brown pollinose. Two pairs intraalar bristles. Halteres pale brownish, more distinctly brown on rims. **Wings:** Pale brown

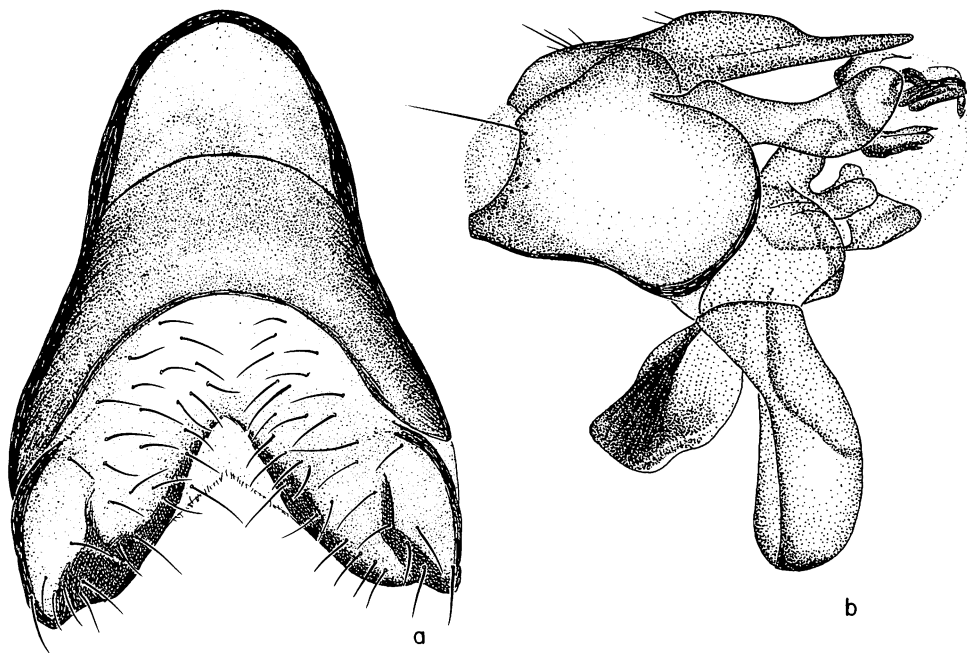


Figure 35—*Lispocephala aquila* n. sp.: a, fifth sternum of male; b, male genitalia.

fumose. *Legs*: Mostly yellow, front femora black over dorsal portion for almost entire length; middle femora black over apical two-thirds on dorsal portion; and hind black on apical two-fifths. Tibiae yellow lightly tinged with brown and tarsi entirely dark brown to black. Front basitarsus about half as long as tibia. Hind tibia with one anteroventral bristle near apical third and hind femur with preapical antero- and posterodorsal bristles but no distinct preapical dorsal (or the posterodorsal is more dorsad in position than normal). Fifth sternum broadly rounded as seen in lateral view and with a small V-shaped cleft as seen from ventral view (fig. 35a). Genitalia as in figure 35b. Extension from the cercus abruptly tapered at apex and surstyli curved gently upward. Parameres not spinulose.

Length of body, 6.5 mm.

FEMALE. Fitting description of male, except for genital characters.

Length of body, 6.3–7.25 mm.

Holotype male: Ainahou Valley, Maui, March 29, 1970 (D. E. Hardy). Allotype female and eight paratypes, one male; seven female same data as type (D. E. Hardy and G. K. Kobayashi). Also one female paratype from Holua, Haleakala Crater, Maui, March 30, 1970 (D. E. Hardy).

Type, allotype in B. P. Bishop Museum. Paratypes in collections of U. S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala aspilota* Hardy, new species (figs. 36a,b)**

Fitting in the *alakaiae* group with no preapical dorsals on hind femora near *rudis* (Grimshaw), by having the legs yellow except for the brown tarsi and the antennae black; but differs by lacking paired spots on the abdominal terga and having the antennae entirely black, except for a tinge of rufous on inner basal portion of third segment. The male genitalia and the fifth sternum are also very probably distinctive (figs. 35a,b); the male of *rudis* has not yet been described.

MALE. *Head*: Shaped as in other members of this group with the head wider than high. Interfrontalia opaque black with a faint tinge of rufous on lower margin and with ocellar triangle and frontal orbits brown pollinose, the former extend almost to a level with upper inferior fronto-orbitals. Face, including the orbits, gray. Antennae entirely black, except for a tinge of rufous at extreme apex of second segment and inner basal portion of third. Palpi yellow. *Thorax*: Brownish pollinose over dorsum, gray on sides. No indication of vittae on mesonotum except for two abbreviated submedian streaks of gray on anterior portion, ending slightly before second pair of presutural dorsocentrals. Two strong intraalars. Calypters yellowish, rather distinctly yellow on rims. *Legs*: Predominantly yellow, tarsi tinged with brown and with apical tarsomeres black. Front basitarsus short, scarcely half as long as tibia. Hind femur with a row of anterodorsals along entire segment and with one preapical posterodorsal but no dorsal bristles. Hind tibia with one anteroventral bristle near apical

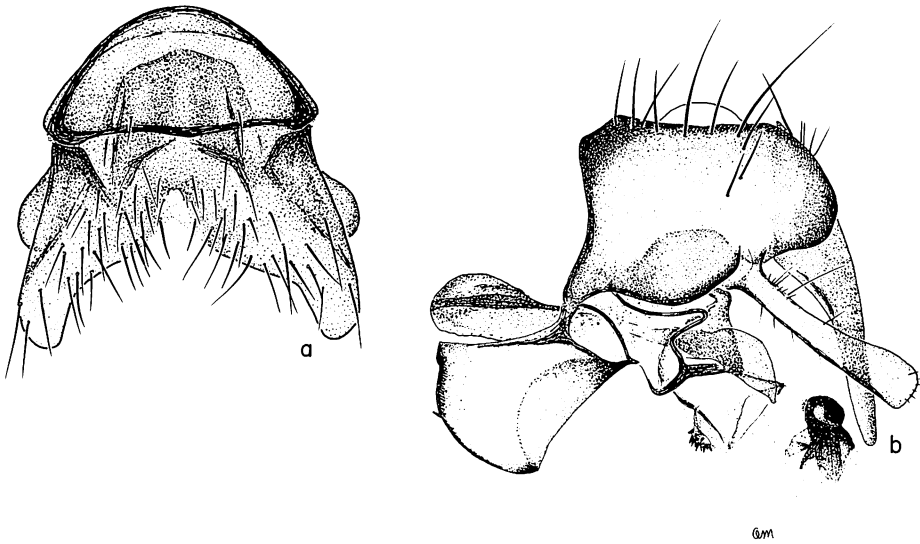


Figure 36—*Lispocephala aspilota* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

two-fifths of segment. *Wings*: Lightly infuscated with brown. Crossvein r-m at middle of cell 1st M_2 . *Abdomen*: Entirely black in ground color, gray-brown pollinose over dorsum, gray on sides and with no paired black spots. The fifth sternum has a V-shaped cleft extending about half its length in middle of hind margin (fig. 36a). The genitalia are as in figure 36b, the extension from the cercus is gradually tapered and the surstyli are clavate. The posterior parameres (postgonites) are spinulose on underside.

Length of body, 4.3 mm.

FEMALE. Fitting description of male except for sexual characters.

Holotype male: Flume Trail, Waikamoi, Maui, 4,000 ft., July 2, 1968 (J. A. Tenorio). **Allotype female** and one male paratype: Waikamoi, Maui, 4,000 ft., August 1958 (D. E. Hardy).

Type and allotype in B. P. Bishop Museum. Paratype in University of Hawaii collection.

***Lispocephala crassifemur* Malloch**

Lispocephala crassifemur Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):87.

Oahu (type-locality: Mt. Kaala). Type female in B. P. Bishop Museum.

This species is known only from the type female which is in rather poor condition, the legs are missing except for one middle leg, and only one wing present. Fitting in the alakaiae group of species by lacking posterior bristles on front tibiae, ventral spinules on femora and preapical dorsals on hind femora; in the complex which has the legs yellow. It differs from any of the other known species by having the antennae yellow to rufous, except for a tinge of

brown on upper portion of third segment, and the ocellar triangle very well developed, elongate, extending nearly to anterior margin of front. Malloch keys it in the group with one or more anteroventral bristles on hind tibia; it very probably has just one anteroventral. It resembles *waialealeae* n. sp., from Kauai, but differs by having the third antennal segment tinged with brown on upper portion; abdomen mostly subshining brown with narrow yellow apices on terga 2-4; ocellar triangle large, conspicuous, extending nearly to lunule; interfrontalia black, covered with yellow-gray pollen; and posterior bristle of middle tibia situated near basal third of segment. Parafrontals and ocellar triangle yellowish pollinose. The thorax is black in ground color, except for the yellow portion of each humerus, and densely gray pollinose with no indications of brown vittae on mesonotum. Two pairs intraalar bristles present. Calypters pale yellow-white, slightly more yellowish on rims. I see no other distinctive features on the type.

Length of body, 5.0 mm.

MALE. Unknown.

***Lispocephala deceptiva* Hardy, new species (figs. 37a-d)**

Appearing to closely resemble *dispar* (Grimshaw), from Molokai, but fitting in a different species group, lacking short, thick ventral spinules on front and middle femora of female; having the femora yellow except for the brown to blackish apices of the hind pair; and crossvein r-m at middle of cell 1st M_2 . The male genital characters and the shape of the fifth sternum (figs. 37a-d) are also probably distinctive; those of *dispar* have not been studied. It fits the alakaiae group and shows relationship to *incompta* n. sp., from Kauai, but the leg markings and male genitalia are very different.

MALE. *Head*: Slightly wider than high with the interfrontalia opaque black, except for a rufous area immediately above lunule. The remainder of head, except for compound eyes, densely gray pollinose and ocellar triangle extending to upper inferior fronto-orbitals. Antennae entirely black, arista pubescent on basal portion. Palpus entirely yellow, long and slender. *Thorax*: Black in ground color, densely gray pollinose, no indication of vittae on mesonotum. Two pairs intraalar bristles present. Calypters white, the upper extends over the basal third to two-fifths of the lower. *Legs*: Front two pairs yellow, except for brown to black tarsi. Hind coxae reddish, tinged with brown. Hind femur yellow, except for brown to black over upper apical portions. Hind tibiae yellow, tinged with brown. Hind tibia with one strong anteroventral bristle near apical three-fifths to two-thirds of segment and hind femur with preapical postero- and anterodorsals but no dorsals. Front basitarsus nearly three-fifths as long as tibia. *Wings*: Lightly infuscated with brown, the r-m crossvein at middle of cell 1st M_2 . *Abdomen*: First three terga yellow, except for a broad brown to black vitta extending down middle. Terga 4 and 5 black, 4 with a narrow yellow border at apex. Fifth sternum of male shaped as in figure 37b. Genitalia as in figures 37a,c,d, with the extensions from the cercus flattened and densely setose on ventral surface at middle. Surstyli slender with short

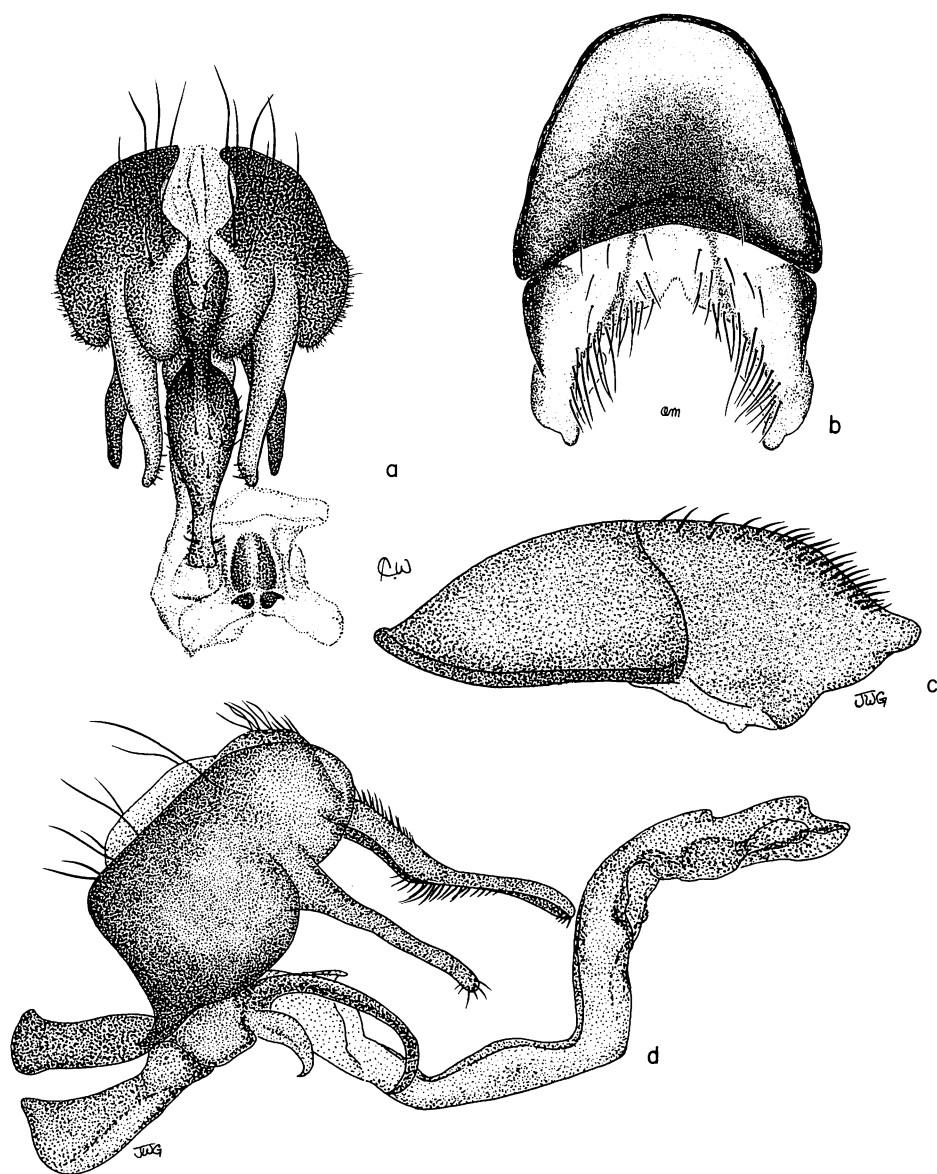


Figure 37—*Lispocephala deceptiva* n. sp.: a, male genitalia, end view; b, fifth sternum, ventral; c, fifth sternum, lateral; d, male genitalia, lateral.

setae at apices, parameres strongly bent downward and hook-like, and aedeagus large and conspicuous.

Length of body, 6.0 mm.

FEMALE. Fitting description of male except for sexual characters. The abdomen is mostly black in ground color, yellow on sides of first two terga and

with narrow apices of terga 2-4 yellow; the mesonotum has a faint tinge of brown in the pollen and the pollen of the ocellar triangle is brownish.

Length of body, 7.0 mm.

Holotype male: Paliku, Haleakala Crater, Maui, August 3, 1971 (D. E. Hardy and M. D. Delfinado). Allotype female: Haleakala, Maui, 5,000 ft. (no date or collector given). Six paratypes, three males and three females; two same data as type, one Mahinahina, Maui, June 21, 1932 (N. L. H. Krauss), and three Ukulele, Maui, July 13, 1919 (collected in *Crabro* nest, P. H. Timberlake).

Type and allotype in B. P. Bishop Museum. Paratypes in collections of U. S. National Museum and the University of Hawaii.

***Lispocephala dentata* Hardy, new species (figs. 38a-c)**

Fitting in the *alakaiae* group which have no posteriors on front tibia or ventral spinules on femora and no preapical dorsal bristles on hind femora. By having the legs mostly black, the palpi yellow and calypters white, it fits near *leptostylata* n. sp., from Kauai. The male genitalia are distinctly different in the two as shown in figures 38a,b and 44a,b; *dentata* is differentiated by having short, stout, ventral teeth at apex of extension from cercus, as well as by other details of the genitalia (figs. 38a,b). It is also differentiated by having the femora all black and abdominal terga 3 and 4 with paired black spots. As noted in the introduction to this genus, *dentata* is probably one of the most primitive of the present day species and rather closely resembles the type of the genus *alma* (Meigen) from North America and Europe. The genitalia of *alma* is as in figures 38d,e.

MALE. *Head:* Distinctly wider than high, interfrontal area brown to blackish, tinged with rufous. Vertex, ocellar triangle, and frontal orbits gray-brown pollinose, the ocellar triangle extends beyond level with lower superior fronto-orbitals. Antennae entirely black, aristae long pubescent or short plumose. *Thorax:* Entirely gray pollinose. Two pairs intraalars present. Calypters white, with a faint tinge of yellow on rims. *Wings:* Subhyaline. I see nothing distinctive about the venation. *Legs:* Mostly black with front tibiae yellow and front tarsi yellow, tinged with brown. Leg bristling as mentioned above, with no preapical dorsals on hind femora (fig. 38c) and hind tibiae each with one anteroventral bristle. The preapical bristle on hind femur is actually borderline between the posterodorsal and dorsal lines (fig. 38c). *Abdomen:* Black, except for a tinge of yellow in ground color on extreme lateral margins of first two terga; rather densely gray pollinose with paired, indistinct, subshining brown spots on terga 3-5. Fifth sternum as in figure 38b, lacking strong hairs or bristles on margin. The extension from cercus with ventral dentations before apex on venter, surstyli large, and other details of genitalia as in figure 38a.

Length of body, 4.0 mm.

FEMALE. Fitting description of male in most respects.

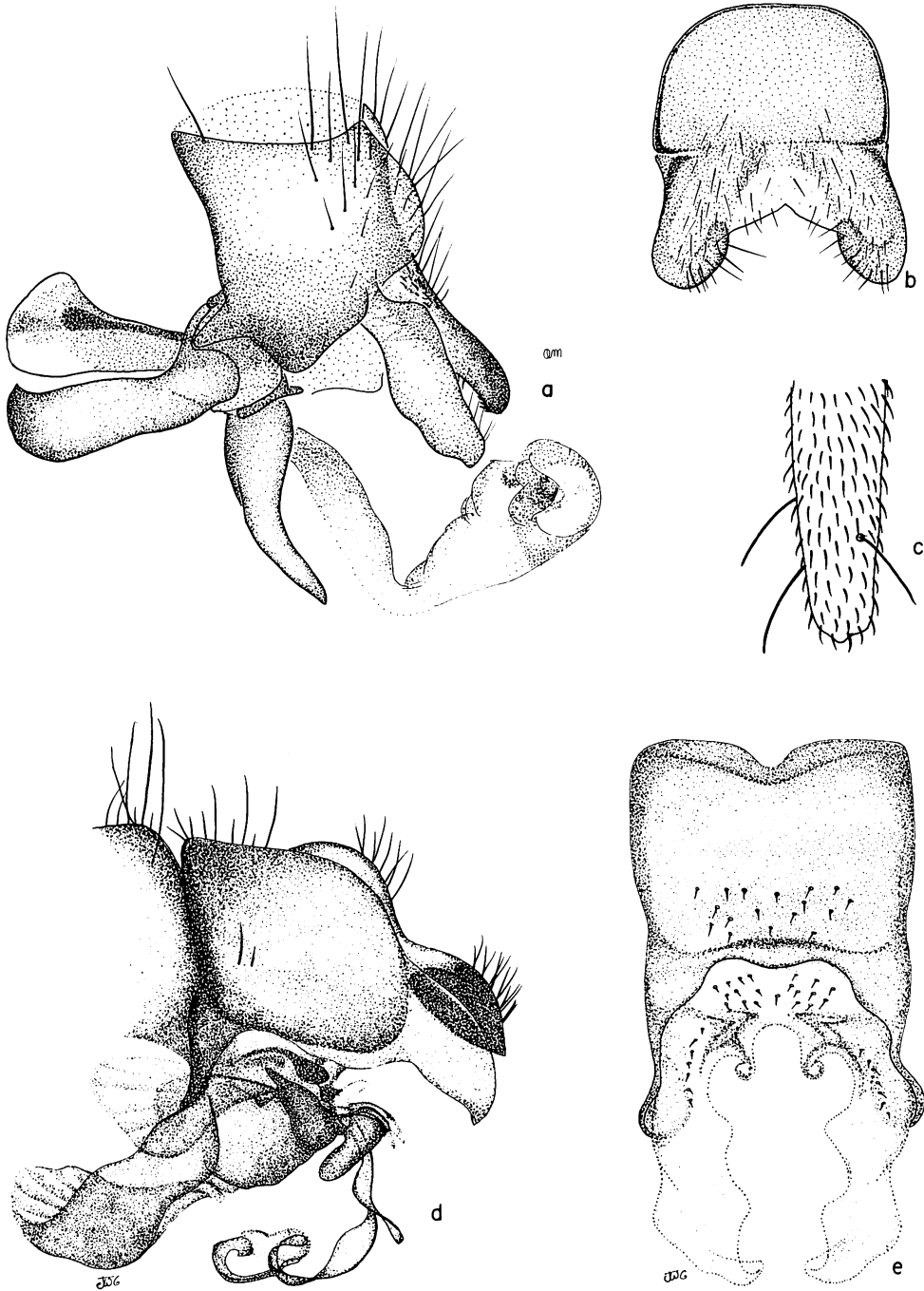


Figure 38—*Lispocephala dentata* n. sp.: a, male genitalia, lateral; b, fifth sternum of male; c, apex of hind femur, dorsal. *L. alma* (Meigen): d, male genitalia, lateral; e, fifth sternum of male.

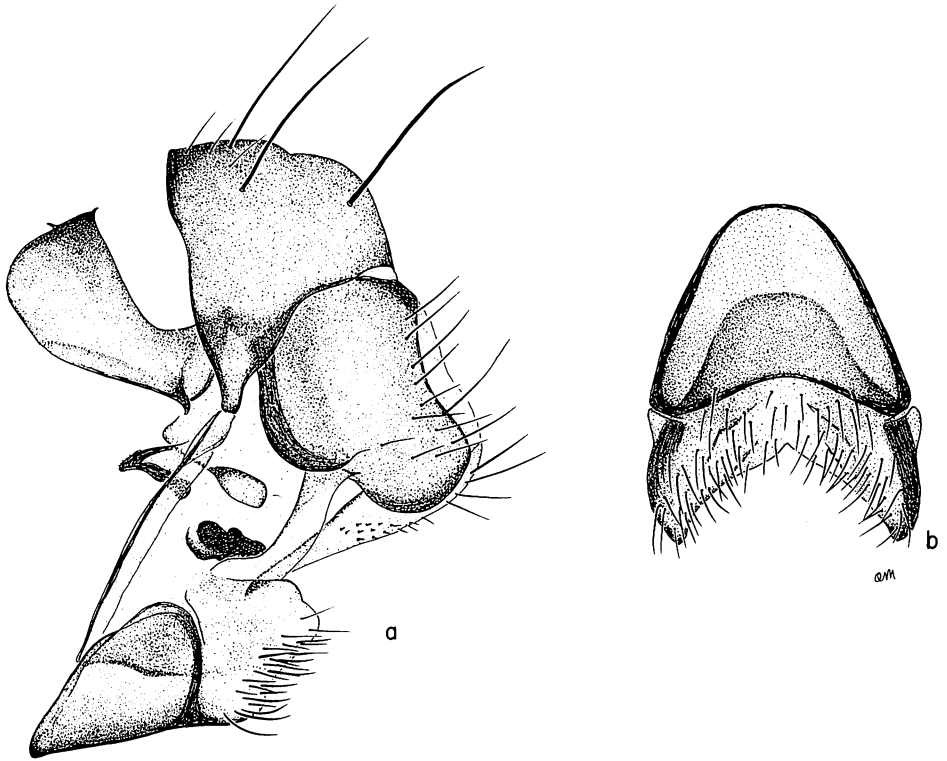


Figure 39—*Lispocephala fusca* Malloch: a, male genitalia, lateral; b, fifth sternum of male.

Holotype male: Koolau Gap, Haleakala Crater, Maui, June 1952 (D. E. Hardy). Allotype female: Haleakala, Puu Oluau, 5,800 ft., Maui, July 17, 1919 (no collector given). One male paratype same data as allotype.

Type and allotype in B. P. Bishop Museum. Paratype in the University of Hawaii collection.

***Lispocephala fusca* Malloch (figs. 39a,b)**

Lispocephala fusca Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):85.

Oahu (type-locality: Waianae Mts.). Type male in B. P. Bishop Museum.

Biology: This species is obviously aquatic in its immature stages. Specimens on hand were collected on wet rocks by falls in Manoa, one specimen was feeding on a *Telmatogeton*, and three puparia were collected at spring where *Gunnera* was growing, on Mt. Kaala. Refer to Williams (1938:115-118) for biological notes and figures of immature stages.

Fitting in the *alakaiae* group by having the abdomen all black, calypters brownish, and parafacials and parafrontals brown pollinose, and all femora broadly brown to black apically; it fits near *aquila* n. sp., from Maui. It is dif-

ferentiated by being mostly grayish pollinose, smaller in size and having the fifth sternum and male genitalia different in development as seen in figures 35a,b and 39a,b.

MALE. *Head:* Wider than high. Interfrontalia dark reddish-brown, orbits and ocellar triangle brown pollinose, the latter extending almost to a level with upper inferior fronto-orbitals. Antennae black, aristae short plumose. *Thorax:* Brownish gray over dorsum, gray on sides. Two pairs intraalar bristles. Calypters fuscous, pale brown on rims. *Legs:* Femora broadly yellow on bases and on venter. The leg bristling as in other members of this complex, with one anteroventral on front tibia and no preapical dorsals on hind femora. Wings lightly infuscated. Abdomen brownish gray pollinose on dorsum, gray on sides and on apical margins of terga. No paired spots on terga. As seen from lateral view, the fifth sternum is nearly truncate at apices and from ventral view, as in figure 39b. The male genitalia are as in figure 39a, with the extension from the cercus gradually tapered and the surstyli gently bent downward at their apices.

Length of body, 4.25–5.0 mm.

Malloch in the original description recorded the type as 6.0 mm. long; I have checked it and it measures 5.0 mm.

***Lispocephala fusciseta* Malloch (figs. 40a,b)**

Lispocephala fusciseta Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):86.

Oahu (type-locality: Kahuauli). Type female in B. P. Bishop Museum. Known only from the Waianae Mountains, most of the specimens seen are from Mt. Kaala.

Fitting in the *alakaiae* group in the complex of species which have the legs yellow except for the tarsi, antennae brown to black, and abdomen with paired black spots on at least terga 4 and 5, also sides of first 2–3 terga broadly yellow. It fits near *molokaiensis* n. sp., from Molokai and *alakaiae* n. sp., from Kauai. It is readily differentiated by the short front basitarsus of male, only about two-fifths as long as tibia, and the latter equal in length to the first four tarsomeres; by having the front tarsi densely yellow-white pilose on ventral portion, with few brown setae intermixed; and by having the fifth sternum and male genitalia very different in development as shown in figures 40a,b and 45a,b.

The male has not been previously described. It fits the general characteristics of most species in this broad grouping, having the head distinctly wider than high. Interfrontalia brown to blackish, lightly covered with gray pollen. Frontal orbits gray pollinose and ocellar triangle brownish gray, extending to about level with lower superior fronto-orbitals. Pedicel of antenna narrowly yellow to rufous at apex and third antennal segment broadly rufous on inner basal portion. Aristae pubescent. Thorax gray, with faint indications of brown vittae down mesonotum, these are slightly more distinct in the male. Two pairs intraalars present. Calypters pale yellowish. Legs mostly yellow to rufous, tinged with brown on tarsi. Front tarsi short, as noted above. The anteroventral bristle on hind tibia strong, three-fourths as long as preapical dor-

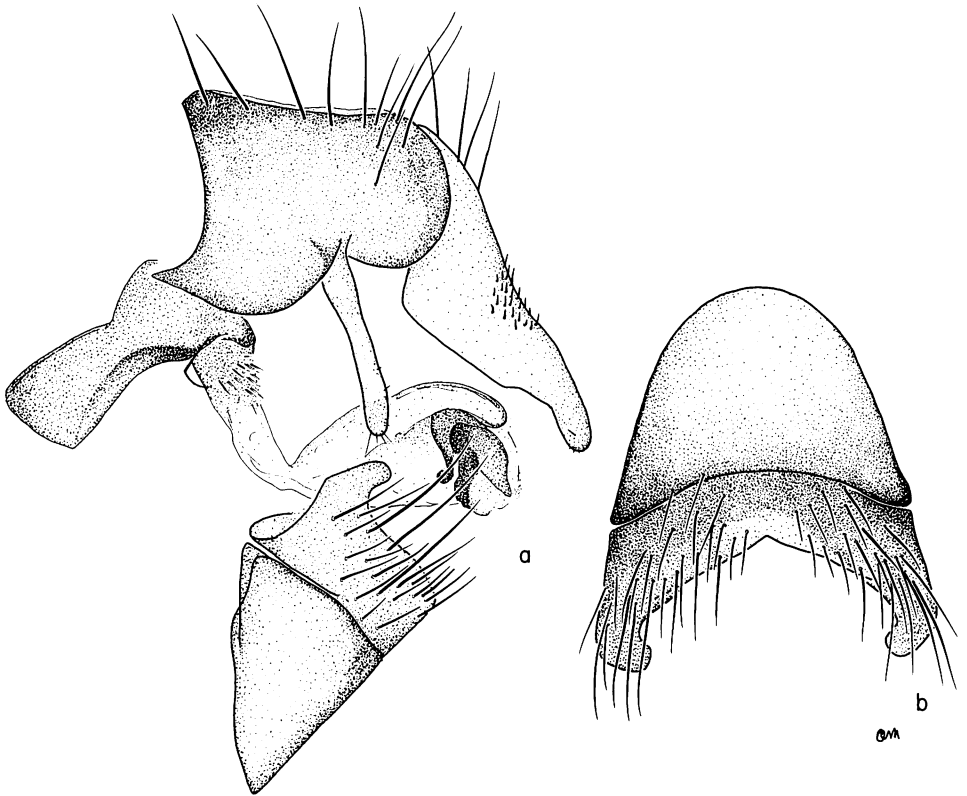


Figure 40—*Lispocephala fusciseta* Malloch: a, male genitalia, lateral; b, fifth sternum of male.

sal bristle. Abdomen with basal three segments broadly yellow on sides, brown to black, lightly gray dusted over dorsum, and with paired subshining dark brown to black spots on terga 3–5 in females and 4–5 in males. As seen from direct lateral view, the fifth sternum terminates in a small rounded lobe on each side at apex (fig. 40a); as seen from ventral view the fifth sternum has a broad V-shaped cleft on hind margin and the margin is rather thickly setose (fig. 40b). The extension from cercus is densely short setose over upper median portion and the surstyli are slender (fig. 40a).

Length of body, 4.25–4.75 mm.

***Lispocephala fuscifacies* Malloch**

Lispocephala fuscifacies Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):83.

Oahu (type-locality: Waianae Mts.).

Type female in B. P. Bishop Museum.

Known only from the type female. The following notes are based upon this specimen. Fitting in the *alakiaie* group of species in the complex which have

dark brown to black legs and palpi. It would run near *ocellata* n. sp. from Maui, Molokai, and Lanai and to *comparata* n. sp., from Kauai; but females of both of these have ventral spinules on the femora and are not related. *L. fuscofacies* is readily differentiated from other black-legged species by lacking paired, shining black spots on terga, having the calypters tinged with brown and the rims distinctly brown, also the anterodorsal bristle on middle of hind tibia is very elongate, extending three-fifths to two-thirds the length of the tibia.

The head is wider than high. The interfrontal area is brown, tinged with rufous. The ocellar triangle, eye orbits, and face are brown pollinose. The ocellar triangle is short, ending at about level with lower superior fronto-orbitals. Thorax entirely gray-brown pollinose with no indication of vittae on mesonotum. Two pairs intraalar bristles. Posterior bristle in middle of mid tibia short, extending scarcely over one-third the distance to apex of segment. Anteroventral bristle of hind tibia rather large, extending two-thirds the distance to apex. Wings pale brown. Crossvein r-m at middle of 1st M_2 . Abdomen entirely black in ground color, lightly brownish gray pollinose.

Length of body, 5.25 mm.

***Lispocephala inconstans* Malloch (figs. 41a-d)**

Lispocephala inconstans Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):85.

Endemic. Oahu (type-locality: Lanihuli). Type male in B. P. Bishop Museum.

To date this has been collected only in the Koolau Mountains or on the windward side of Oahu. A series of specimens on hand from Mt. Olympus Trail, December 1910, were collected in "cell of *Crabro tumidoventris*."

A small species fitting in the alakaiae group of species, and I am unable to relate it to any other presently known Hawaiian species. It is readily differentiated by having only one preapical posterior bristle on mid femur, the males lacking median posterior bristles on middle tibia, also the development of the fifth sternum of the male and the genitalia are distinctive (figs. 41b,c). The middle tibia of the female has the posterior bristle and specimens of this sex are differentiated from other yellow-legged species in this general grouping by lacking anteroventral bristles on hind tibiae; posterior bristle of middle near basal third of segment; and middle femur with only one preapical posterior bristle.

Antennae, palpi, and legs entirely yellow. *Head*: As in figure 41d. Comparatively broad, one-third to one-fourth wider than high, with front, measured from median ocellus to lunule, slightly wider than long. Interfrontalia mostly rufous, tinged with brown, the remainder of head, except eyes, densely gray pollinose and the ocellar triangle extending approximately to a level with upper inferior fronto-orbital bristles. Aristae pubescent. *Thorax*: Densely gray pollinose. Two intraalar bristles present. Calypters pale yellow-white. *Legs*: As noted above and with bristling of hind legs in the usual arrangement except that anteroventrals are lacking on the hind tibiae and preapical dorsals are

lacking on the hind femora. Wings hyaline, I see nothing distinctive about the venation (fig. 41a). *Abdomen*: Of male, with first two terga and sides and basal portion of third yellow, otherwise reddish brown to blackish in ground color, covered with gray pollen and with apices of three and four densely gray. In the female, the third tergum is mostly reddish brown. Rather indistinct, subshin-

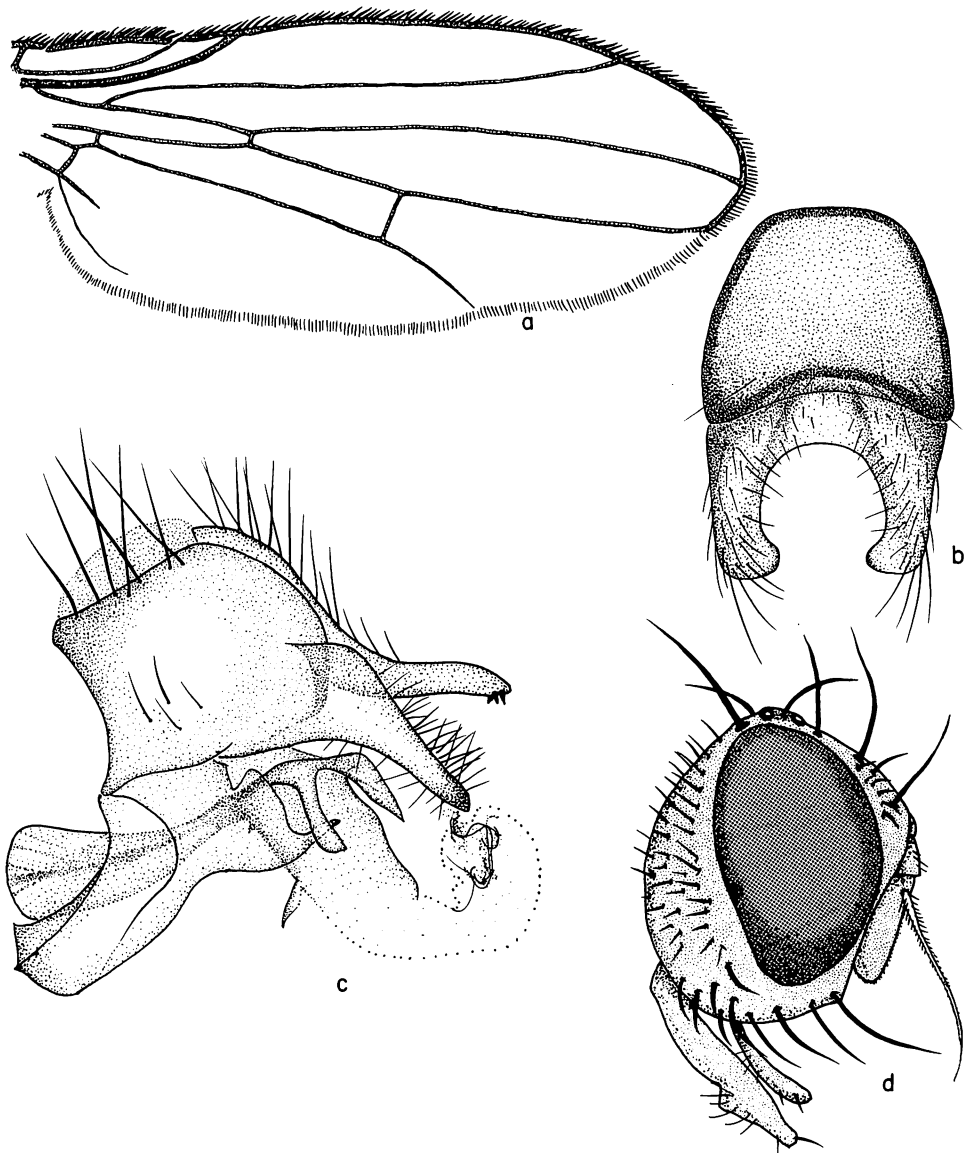


Figure 41—*Lispocephala inconstans* Malloch: a, wing; b, fifth sternum of male; c, male genitalia, lateral; d, head, lateral.

ing, brown paired spots are present on terga 3-5 on the female and 4-5 in the male. Fifth sternum of male shaped as in figure 41b, with entire margin densely yellow pilose and pubescent. The genitalia are as in figure 41c. The extension from the cercus has several short, preapical, ventral spines.

Length of body, 3.25-3.75 mm.

***Lispocephala incompta* Hardy, new species (figs. 42a-c)**

Fitting the *alakaiae* group and showing closest relationship to *deceptiva* n. sp., from Maui. It is readily differentiated by having the apical two-thirds of the legs brown to black, the palpi mostly black, and the fifth sternum and male genitalia very different in development as shown in figures 42a-c.

MALE. *Head:* Entirely black in ground color, except for tinge of rufous on lower portion of front. Parafrontalia brown pollinose. Face yellow-brown pollinose. Antennae entirely black. Aristae short plumose. *Thorax:* Entirely black, densely dull gray pollinose. Calypters pale, rims light yellow. *Legs:* Front coxae, all trochanters, and bases of femora yellow. Femora otherwise brown to blackish with extreme apices narrowly yellow. Tibiae yellow and tarsi brown, tinged with yellow. The bristling of the legs is similar to that of other species of the *alakaiae* group. *Wings:* Infuscated, crossvein r-m situated at mid-

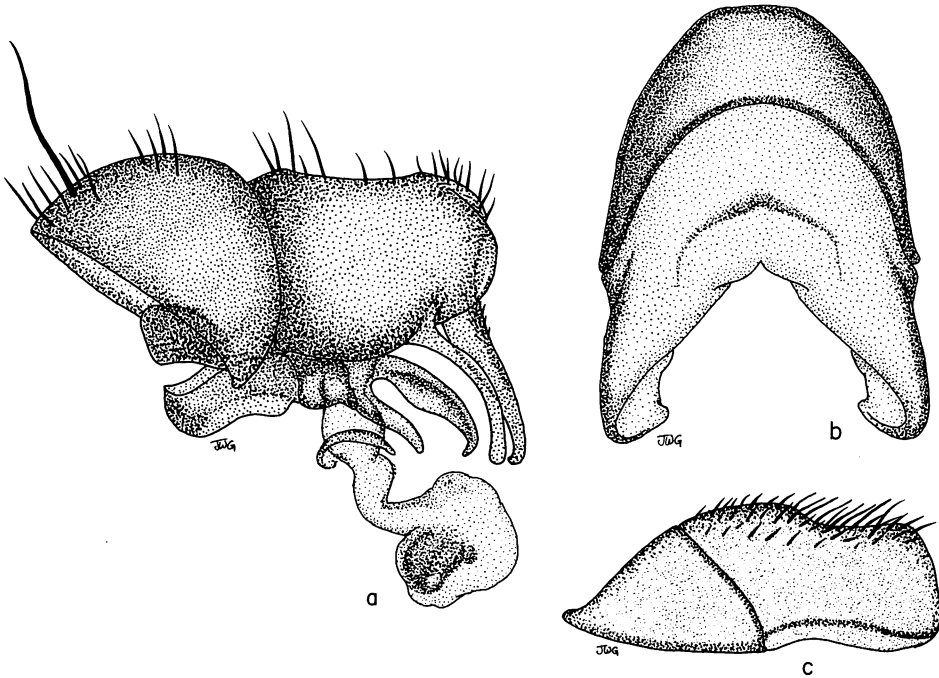


Figure 42—*Lispocephala incompta* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral; c, fifth sternum, lateral.

dle of 1st M₂. *Abdomen*: Predominantly black, yellow on sides of terga 1-3, and mostly subshining rather lightly gray pollinose. Lobes of fifth sternum broad, rounded (figs. 42b,c). Surstyli slender, gently curved and parameres bilobed (fig. 42a).

Length of body, 4.5 mm.

FEMALE. Unknown.

Holotype male: Waialeale, Kauai, 5,000 ft., August 1974 (C. Corn).

Type in B. P. Bishop Museum.

***Lispocephala intonsa* Hardy, new species (figs. 43a,b)**

Fitting in the *alakaiae* group of species in the complex of species which have femora yellow basally, broadly brown to black at apices; abdomen all black; calypters brownish and parafacials and parafrontals brown pollinose. Fitting near *aquila* n. sp., but differing by having the basitarsi slender, nearly two-thirds as long as tibiae; fifth sternum of male densely black setose along postero-median margin (fig. 43a) and genitalia as in figure 43b.

MALE. *Head*: Wider than high with interfrontalia brown, tinged with rufous. Ocellar triangle, parafrontals, and parafacials brown pollinose; face gray. Antennae black, aristae pubescent on basal portions. Palpi entirely yellow. *Thorax*: Brownish gray pollinose, subshining on dorsum. Only one pair of intraalar bristles developed. Calypters brownish, especially on rims. *Wings*: Subhyaline, crossvein r-m near middle of cell 1st M₂. *Legs*: Mostly yellow, brown on mid and hind coxae, broad apices of femora and dark brown to black on tarsi. Front tarsi slender, the basitarsus two-thirds as long as tibia. One anteroventral bristle on hind tibia situated near apical third of segment. Hind femur with preapical postero- and anterodorsals but no dorsals. *Abdomen*: Subshining black, tinged lightly with yellow in ground color on sides of first tergum and lightly gray-brown pollinose. Fifth sternum shaped as in figure 43a, thickly setose over median portion. Genitalia as in figure 43b, extension from cerci with a pair of small, black, ventral spines before apex.

Length of body, 5.0 mm.

FEMALE. Fitting description of male except for sexual characters; also, the two specimens on hand which seem to be the same as the male have two intraalar bristles rather than one.

Holotype male: Waikamoi, Maui, 4,000 ft., August 1958 (D. E. Hardy).

Allotype female: Waihoi Valley, Maui, 2,780 ft., July 1972 (W. Ibara). One female paratype, Puu Kukui, Maui, June 1953 (C. R. Joyce).

Type and allotype in B. P. Bishop Museum. Paratype in University of Hawaii collection.

***Lispocephala* new species, *intonsa*-like?, "A" from Hawaii**

Two female specimens from Puna Forest Reserve, Hawaii, 1,600 ft., May 7, 1972 (S. L. Montgomery), appear to belong in the complex of species near *intonsa-aquila*. This cannot be placed until the male is associated. Female specimens appear to be distinctive because of the large ocellar triangle, which

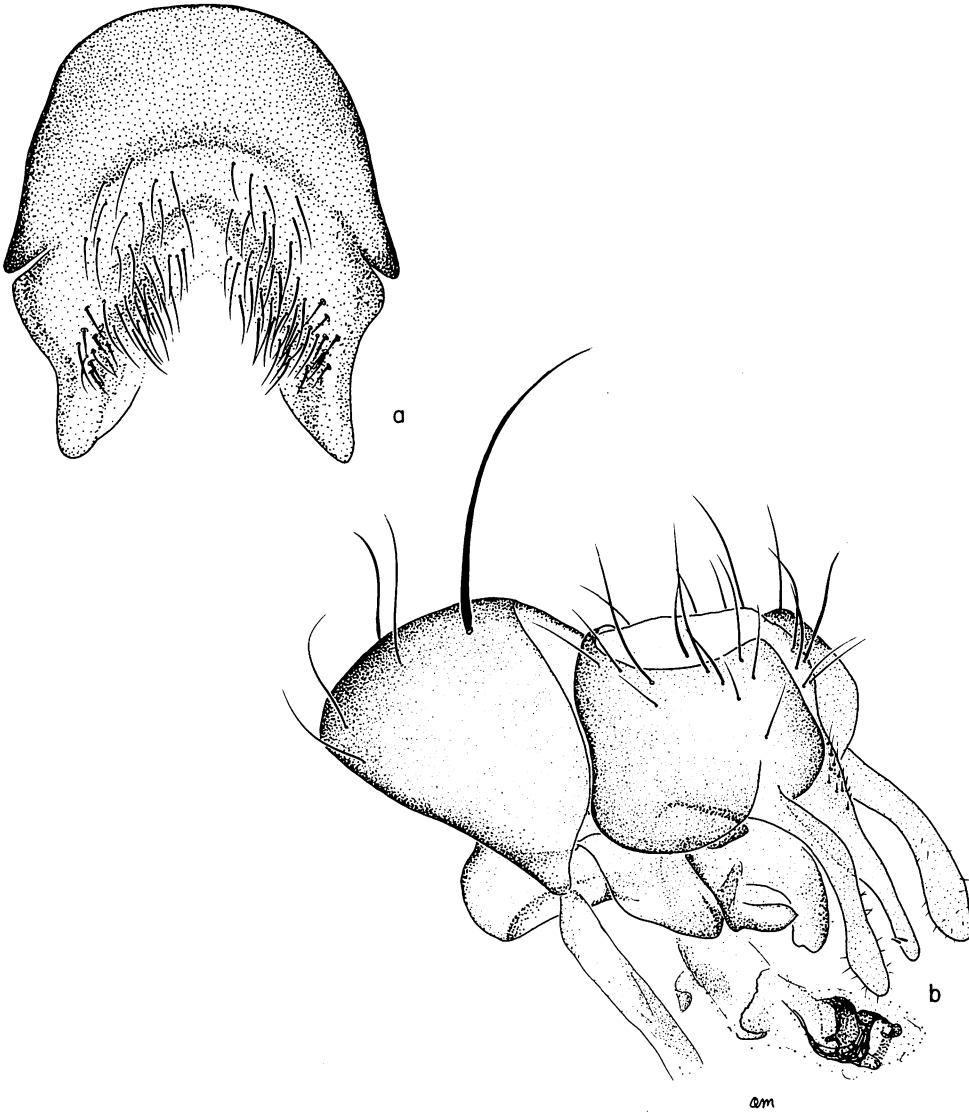


Figure 43—*Lispocephala intonsa* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

extends to or very near the anterior margin of the front, and also by having the entire dorsum of thorax and abdomen subshining black.

The two specimens are in the University of Hawaii collection.

***Lispocephala leptostylata* new species (figs. 44a,b)**

Fitting the characteristics of *dentata* except that the dorsum of the thorax is gray-brown pollinose rather than gray, the bases of femora are yellow and the

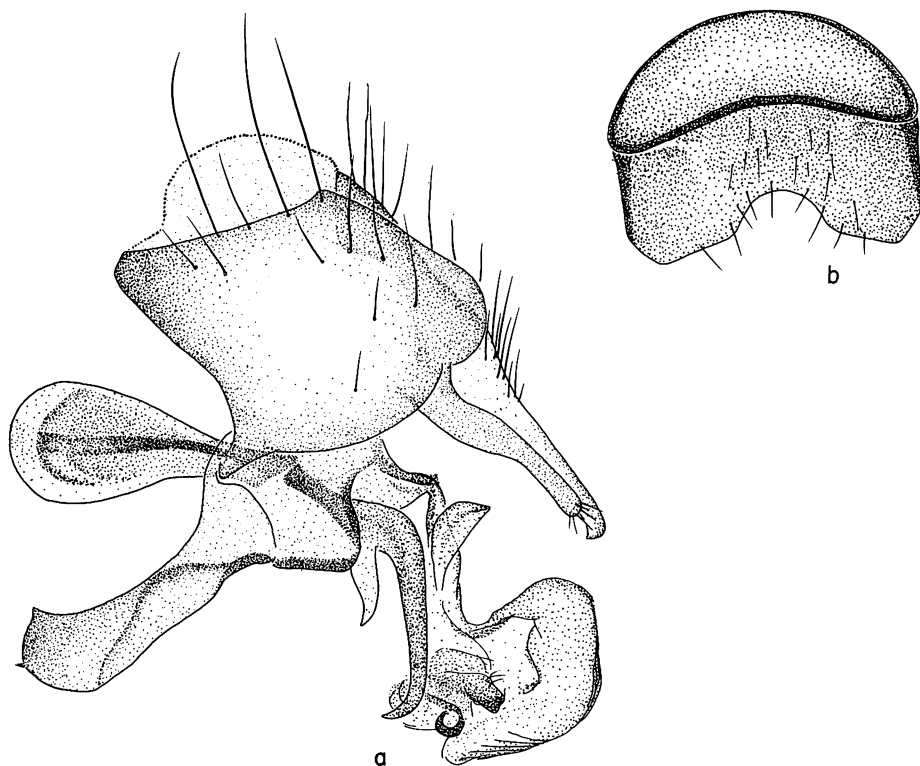


Figure 44—*Lispocephala leptostylata* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

abdomen is entirely gray-brown pollinose lacking any indications of paired spots. The male genitalia are very distinctive: the fifth sternum shaped as in figure 44b; the extension from the cercus lacking stout ventral teeth at apex; surstyli slender, parallel-sided and parameres slender, curved downward at apices (fig. 44a).

Length of body, 4.0 mm.

FEMALE. UNKNOWN.

Holotype male: Kokee, Kauai, June 23, 1932 (O. H. Swezey). One male paratype Alakai Swamp, Kauai, 4,000 ft., August 1953 (D. E. Hardy).

Type in B. P. Bishop Museum. Paratype in University of Hawaii collection.

***Lispocephala molokaiensis* Hardy, new species (figs. 45a,b)**

Belonging in the *alakaiae* group and the *fusciseta* complex of species by having the legs mostly yellow, sides of abdomen yellow on basal segments, and antennae mostly black. By having the front tarsi rather elongate and slender, with the basitarsus over half as long as tibia, and the latter only slightly longer

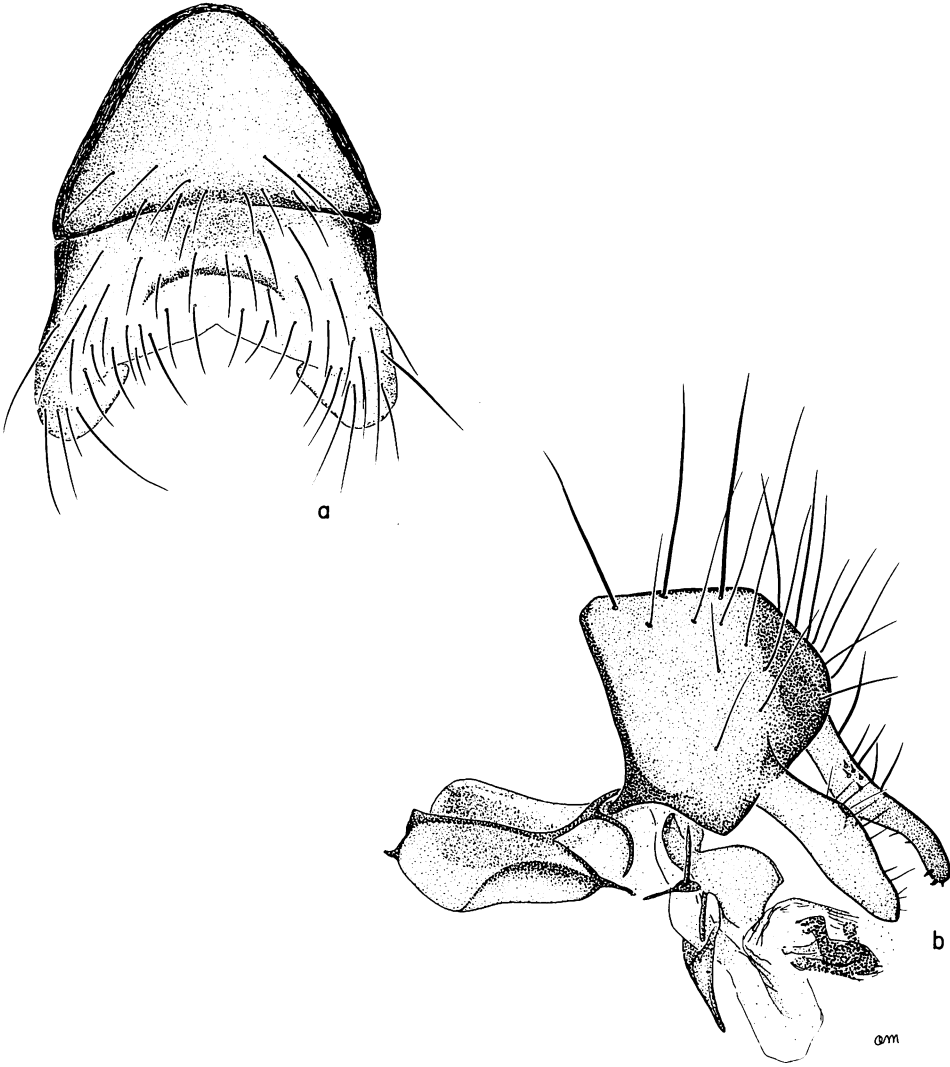


Figure 45—*Lispocephala molokaiensis* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

than first two tarsomeres with the front tarsus brown setose and pilose ventrally, it fits near *alakaiae* n. sp. from Kauai, but the fifth sternum and male genitalia are very different in development and the two are probably not related (figures 34a,b; 45a,b). Also, *molokaiensis* has prominent, shining black, paired spots on terga 3–5 in both sexes and the face is golden gray pollinose.

MALE. Head: Wider than high, with interfrontalia reddish brown to blackish in ground color, lightly gray pollinose. Ocellar triangle brown pollinose and extending approximately to a level with lower superior fronto-orbitals.

Parafrontalia gray-brown pollinose, discoloration extending onto the upper portion of the parafacials. Face golden gray pollinose. Inner apex of pedicel and inner basal portion of third antennal segment rufous. Aristae pubescent basally. Palpi yellow, slender, straight-sided, with numerous black setae on outside surface. *Thorax*: Gray, mesonotum tinged with brownish on sides but no distinct brown vittae. Two pairs intraalar bristles. Calypters yellowish, especially on rims. *Wings*: Lightly infuscated, the r-m crossvein situated at or slightly before middle of cell 1st M_2 . *Legs*: Almost all yellow, with tarsi tinged brown to black. Front tarsi slender, as stated above. Anteroventral bristle of hind tibia situated near apical two-thirds of segment and extending slightly over half the distance to apex of segment. *Abdomen*: Mostly black in ground color as seen from dorsal view with sides of first three terga broadly yellow and with narrow apices of terga 2-5 yellow. Dorsum gray pollinose with distinct, subshining, dark brown to black, paired spots on terga 3-5. Fifth sternum rounded apically and with a U-shaped concavity in middle of hind margin (fig. 45a). Extension from cercus with strong ventral preapical teeth and surstyli rather broad (fig. 45b).

Length of body, 4.5 mm.

FEMALE. Fitting description of male except for sexual characters, also the sides of first two terga are more narrowly yellow and the third is mostly brown with a yellow rim along posterolateral margins. The dorsum is largely subshining black rather lightly gray pollinose.

Holotype male: Pepeopae, Molokai, 4,000 ft., July 30, 1951 (D. E. Hardy). Allotype female same locality, August 28, 1964 (D. E. Hardy). 49 paratypes, 31 males and 18 females, many same data as type and allotype. Also, large series from Puu Kolekole, Molokai, 3,600 ft., June-October 1952-1964 (D. E. Hardy, M. Tamashiro, and H. T. Spieth), and one from Molokai Forest Res., December 1969 (J. Obata).

Type, allotype, and series of paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of U. S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala parydra* Hardy, new species (figs. 46a-c)**

Fitting in the *alakaiae* group of species in a complex with entirely opaque black bodies and legs. Because of the brown calypters, it fits near *philydra* n. sp., from Hawaii, and differs by having the parafacials brown pollinose, contrasting from gray-white face; preapical dorsal bristle of hind tibia elongate, longer than basitarsus and one-third as long as tibia; humeri, pleura, and first abdominal tergum dull gray, not sharply contrasting from mesonotum; front basitarsi of male about half as long as tibiae and genitalia differing as shown in figures 46a-c, 49a-c.

MALE. Head: Wider than high, interfrontalia opaque black, ocellar triangle and eye orbits brown pollinose; the triangle extends almost to a level with upper inferior fronto-orbitals. Face silvery white except for pale brown parafa-

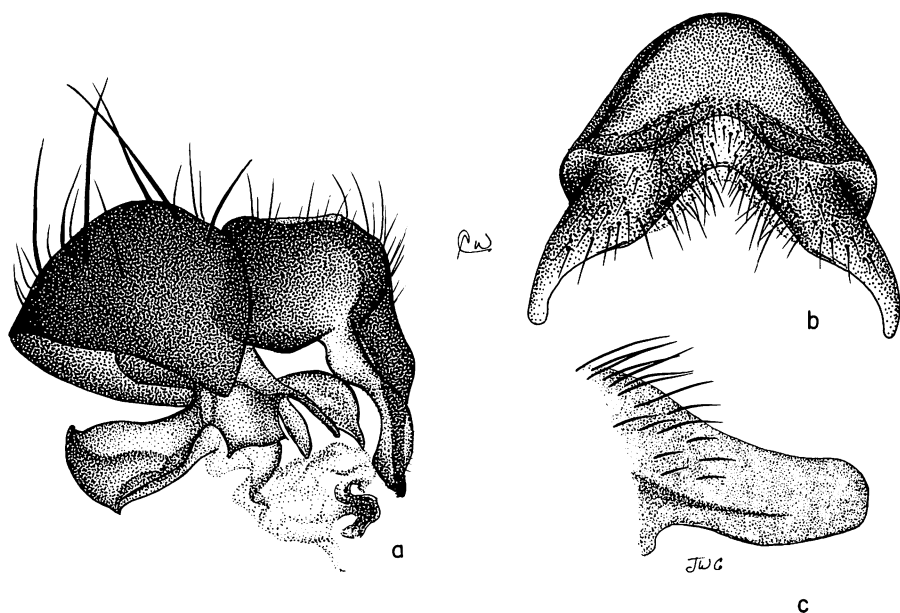


Figure 46—*Lispocephala parydra* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral; c, lobe of fifth sternum, lateral.

cials. Antennae entirely black, aristae short plumose or long pubescent on basal halves, and palpi entirely yellow. *Thorax*: Subshining black, lightly dusted with brownish pollen over dorsum, dull gray over humeri, lateral margins of mesonotum, and over pleura. Two intraalar bristles. Calypters dark fumose with rims brown. *Legs*: Entirely black except for very narrow ring, or tinge of yellow at apices of femora and bases of tibiae, and sometimes narrow bases of hind femora, and also with trochanters yellow tinged. Front basitarsus about half as long as tibia. Hind tibia with only one anteroventral bristle. *Wings*: Evenly brown fumose. *Abdomen*: Entirely subshining black, rather lightly gray-brown pollinose. Fifth sternum in ventral view shaped as in figure 46b with a broad V-shaped cleft in middle of hind margin and densely fine haired but lacking bristles. As seen in lateral view, the lobes of the sternum are as in figure 46c. Genitalia as in figure 46a, extension from cercus with preapical ventral dentations and surstyli rather strongly curved downward.

Length of body, 6.0–6.75 mm.

FEMALE. Fitting description of male except for sexual characters, also with the ocellar triangle extending distinctly beyond level with upper inferior fronto-orbitals.

Length of body, 6.5–7.0 mm.

Holotype male: Puu Kolekole, Molokai, 3,600 ft., June 10, 1964 (D. E. Hardy). Allotype female same locality and collector as type, July 30, 1959. Fourteen paratypes, 10 males and 4 females, mostly same locality as type,

some collected along streams May–August 1952–1965 (D. E. Hardy and M. Tamashiro); also Wailau Pass, Molokai, collected on dripping moss at spring, December 17, 1957 (F. X. Williams); E. Molokai Mts., 2,400 ft., November 28, 1933 (F. X. Williams); and Pepeopae, Molokai, 4,000 ft., July 30, 1959 (D. E. Hardy).

The larvae are very probably aquatic.

Type, allotype, and some paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of the U. S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala pectinata* Hardy, new species (figs. 47a–d)**

Fitting in the *alakaiae* group of species in the complex with legs mostly black and differentiated from all known species by having rows of strong bristles on the mid (fig. 47a) and hind tibiae of both sexes and the fifth sternum of male having a pecten of closely placed, stout bristles on each margin (figs. 47c,d).

MALE. *Head:* Slightly broader than high with front broad, from median ocellus to lunule the length is about equal to width. Interfrontalia opaque black, frontal orbits and ocellar triangle pale brown pollinose, the ocellar triangle extends to a level approximately halfway between lower superior fronto-orbital and upper inferior fronto-orbital bristles. Antennae entirely black, aristae long pubescent on basal halves. Palpi entirely yellow. *Thorax:* Densely gray pollinose with no indication of vittae on mesonotum. Two pairs of well-developed intraalar bristles. Calypters pale yellowish, the rims distinctly yellow. *Legs:* Entirely black except for narrow bases and apices of tibiae. Front femur with complete rows of posterodorsal and posteroventral bristles. Front tibia with a row of erect posterior hairs over entire length. Middle tibia with a row of very strong posterodorsal bristles, those on median portion are four-fifths as long as tibia (fig. 47a). Mid femur with two preapical posterior bristles. Hind tibia with a complete row of strong anterodorsal bristles and a complete row of small posterodorsals; in addition to a strong preapical dorsal bristle which is almost equal in length to two basal tarsomeres; also with three anteroventrals beyond middle of segment. Front basitarsus short, scarcely two-fifths as long as tibia. *Wings:* Subhyaline. I see nothing distinctive about the venation. *Abdomen:* Entirely gray-brown pollinose with subopaque, black, paired spots on terga 3–5, visible as seen in end view, very indistinct from direct dorsal view. The pecten on fifth sternum as in figures 47c,d and male genitalia as in figure 47b, the surstylus being slightly capitate, rounded at apex.

Length of body, 6.0–6.25 mm.

FEMALE. Fitting characteristics of the male, even having the rows of strong bristles on tibiae, except for genital characters.

Length of body, 7.0–7.5 mm.

Holotype male and allotype female: Upper Hana Forest, Maui, 6,700 ft., July 1973 (C. Whittle). Ten paratypes, 7 males and 3 females, from following

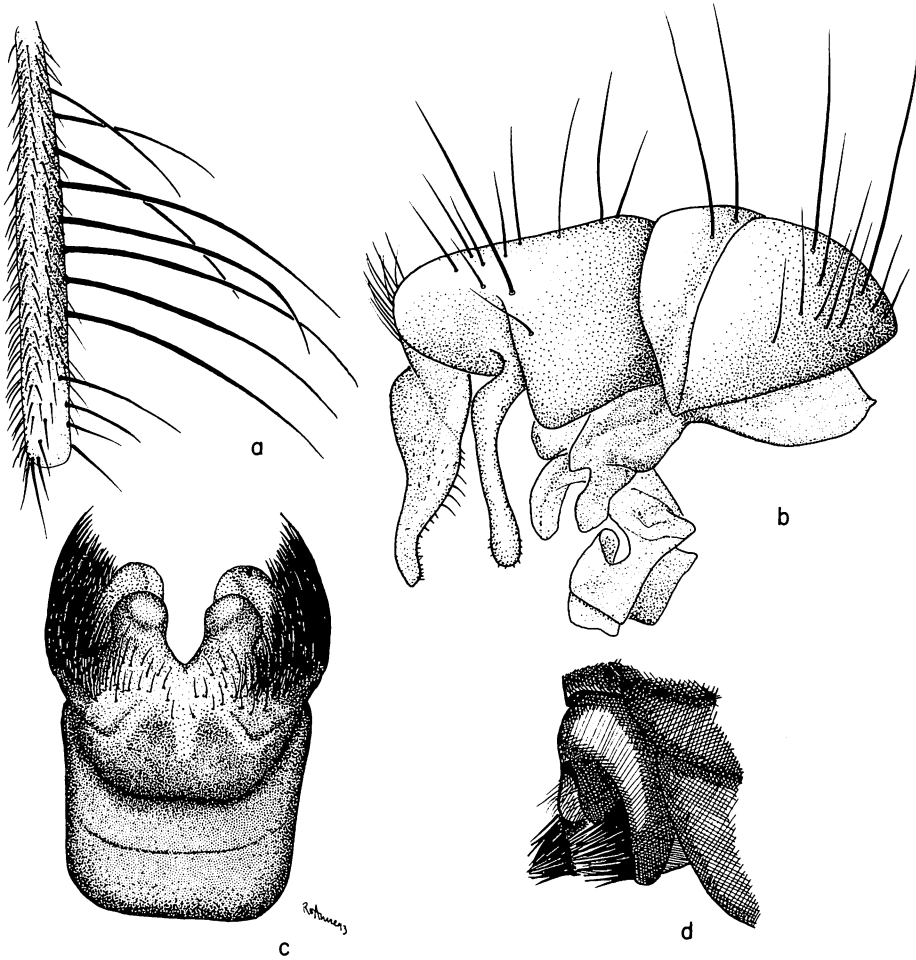


Figure 47—*Lispocephala pectinata* n. sp.: a, middle tibia, dorsal; b, male genitalia, lateral; c, fifth sternum of male, ventral; d, fifth sternum, lateral.

localities on Maui: same data as type; Lake Waieleele, Upper Hana Forest, 6,700 ft., July 25, 1973 (C. Whittle), Haleakala, 5,800 ft., July 1919 (no collector given), and Puu Kukui Trail, July 5-6, 1973 (W. Ibara).

Type, allotype, and some paratypes in B. P. Bishop Museum. Others in collections of the U. S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala penaquila* Hardy, new species (figs. 48a,b)**

Fitting in the *alakaiae* group of species near *aquila* and fitting most of the characteristics of that species. It differs by having the ventral surfaces of the

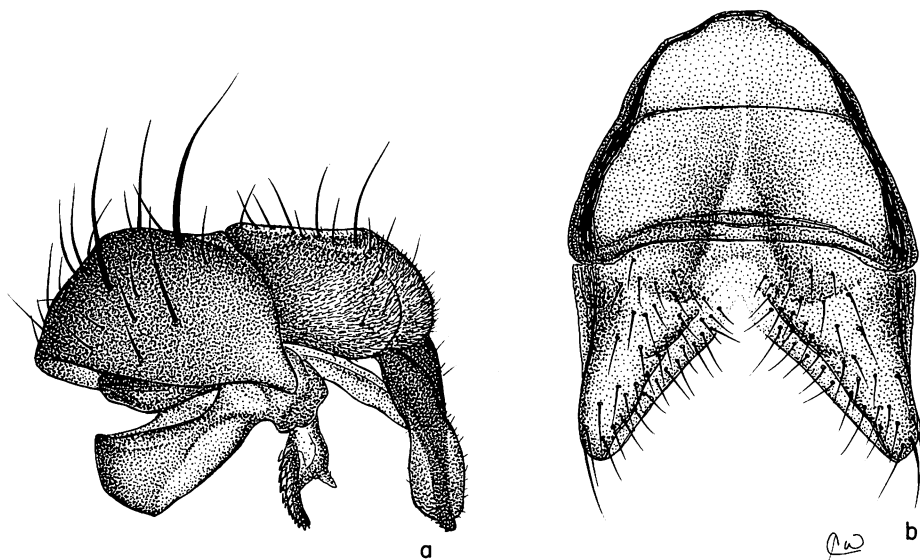


Figure 48—*Lispocephala penaquila* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

mid and hind femora much more conspicuously and densely setose, especially along anteroventral and posteroventral margins. The mid and hind femora mostly dark brown, rufous only at their bases; fifth sternum not so elongate, about as wide as long, with the lobes gently tapered apically (fig. 48b), and the surstylus expanded apically but slightly bent downward, not curved upward, and the posterior parameres (postgonites) are densely spinulose on the underside (fig. 48a).

Length of body, 6.0 mm.

FEMALE. Unknown.

Holotype male: Paliku, Haleakala Crater, Maui, 6,500 ft., August 23, 1963 (D. E. Hardy).

Type in B. P. Bishop Museum.

***Lispocephala perflava* Hardy, new species**

Belonging in the *alakaiae* group in the complex of species which have the legs entirely yellow. It is differentiated from all known species by having the head and thorax predominantly yellow and by having only one pair of presutural dorsocentrals. It superficially resembles *montgomeryi*, from Kauai, which also lacks postero- and anterodorsal bristles on front tibia basad of median pair, but that species has the front dark brown in ground color, has prominent brown markings on posteromedian portion of mesonotum, has two pairs presutural dorsocentrals, one prominent preapical dorsal bristle on hind femur, and it has the wings conspicuously brown to blackish fumose on upper apical

portion, rather than hyaline. By lacking postero- and anterodorsal bristles on hind tibia basad of median pair, it would seem to fit in a complex with *striata* (Grimshaw) from Oahu but the two are very different in coloration and other details.

FEMALE. *Head:* Slightly wider than high and entirely yellow in ground color, except for the compound eyes, ocellar triangle, and upper median portion of occiput and sides of vertex, which are blackish. Interfrontal region pale, opaque yellow; ocellar triangle, orbits, and face yellow-gray pollinose. Ocellar triangle short, ending before a level with lower superior fronto-orbitals. Antennae, palpi, and mouthparts entirely yellow and aristae yellow, moderately long plumose. Third antennal segment extending about $2/3$ the length of the front. *Thorax:* Entirely yellow except for brown-red tinge on mesonotum between dorsocentral rows and also tinged with brown on sides of scutellum. Two pairs intraalar bristles and only one pair presutural dorsocentrals. Calyp- ters entirely pale yellow-white, the lower is scarcely one-half as long as scutellum. *Legs:* Entirely yellow, hind femur with preapical posterodorsal and anterodorsal but no dorsals. Hind tibia with one strong anteroventral before middle and with no posterodorsal or anterodorsal bristles basad of the median pair. Posterior bristle of middle tibia small, extending scarcely one-fourth the distance to apex of segment. *Wings:* Entirely hyaline, crossvein r-m situated at middle of cell 1st M_2 . *Abdomen:* Mostly yellow in ground color, tinged with reddish brown in median portions of terga 3 and 4 and slightly blackish on base of fifth tergum. Terga 3 and 4 with indications of subshining paired brownish spots.

Length of body, 3.5 mm.

MALE. Unknown.

Holotype female: Kainalu, Molokai, 2,000–3,000 ft., July 28, 1927 (E. H. Bryan, Jr.).

Type in B. P. Bishop Museum.

***Lispocephala philydra* Hardy, new species (figs. 49a–c)**

Fitting in the *alakaiae* group near *parydra* n. sp., from Molokai, differing by the development of the fifth sternum of male and male terminalia (figs. 46a–c, 49a–c); by having parafacials gray-white pollinose, concolorous with the face; preapical dorsal bristles of hind tibia short, much shorter than basitarsus and less than one-fourth as long as tibia; humeri, pleura, and first tergum densely gray-white pollinose contrasting from brown mesonotum; male basitarsus two-thirds as long as tibia and middle femur with two posteroventral bristles situated on basal third of segment, and the femora of all legs sparsely setose ventrally. The wings are lighter brown fumose than in *parydra* and the abdomen is gray-brown pollinose on dorsum, ashy gray on sides. Otherwise, except for genitalia, fitting the description of *parydra*. The fifth sternum has a moderately deep V-shaped cleft in middle of hind margin and is shaped as in figure 49b. The extension from the cercus has minute ventral dentations

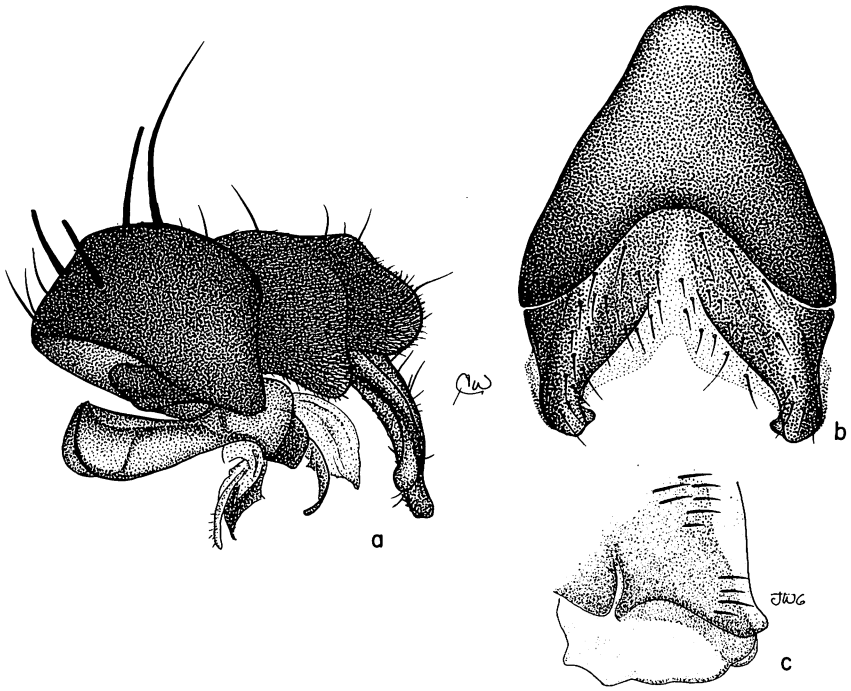


Figure 49—*Lispocephala philydra* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral; c, apex of fifth sternum, lateral.

before apex and the surstyli are slender, slightly curved downward, and very slightly enlarged at apices (fig. 49a).

Length of body, 5.0 mm.

FEMALE. Fitting description of male except for sexual characters.

Length of body, 5.5–6.0 mm.

Holotype male and allotype female: Honokane Nui Stream, Kohala Mts., Hawaii, 1,200 ft., July 7, 1971 (D. E. Hardy). Collected on wet rocks in swift flowing stream. Twenty-five paratypes, 10 males and 15 females, mostly same data as type. Some from Honopue Stream, Kohala Mts., 2,000 ft., June 12, 1970 (on rocks in stream) (W. C. Gagne); Kapehu Stream, Hawaii, 1,720 ft., March 25, 1971 (D. E. Hardy); Wailuku River, Hawaii, 1,270 ft., June 25, 1971 (J. A. Tenorio).

Type, allotype, and some paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of U. S. National Museum, British Museum (Natural History), and the University of Hawaii.

The larval and pupal stages of this fly are spent in mosses in the swift running streams, they have been collected two feet below the water surface in the swift water and obviously prey on an assortment of aquatic insects living in the moss. The adults are found living on the wet rocks just above water lines and

in the area subject to splashing from the torrential water where they prey upon the adults of the aquatic insects: crane flies, *Telmatogeton*, Canaceidae, Ephydriidae, and probably others.

***Lispocephala rudis* (Grimshaw) (figs. 50a-c)**

Coenosia rudis Grimshaw, 1901, Fauna Haw. 3(1):40.

Maui (type-locality: Haleakala, 5,000 ft.). Two syntype females in British Museum (Natural History). It occurs in the mountains of both east and west Maui.

Fitting in the alakaiae group of species, in the subgroup with yellow legs and palpi and body mostly gray. It fits nearest to *aspilota* n. sp., from Maui, but the two are probably not closely related and *rudis* differs by having paired, black spots on the abdominal terga and by the different development of the fifth sternum and genitalia of the male (figs. 50a-c with figs. 36a,b).

Similar in most details to other species of the alakaiae group of species. Body gray pollinose with no distinct brown markings on the thorax and abdomen with paired, subshining, dark-brown to black spots on terga 3-5 in females

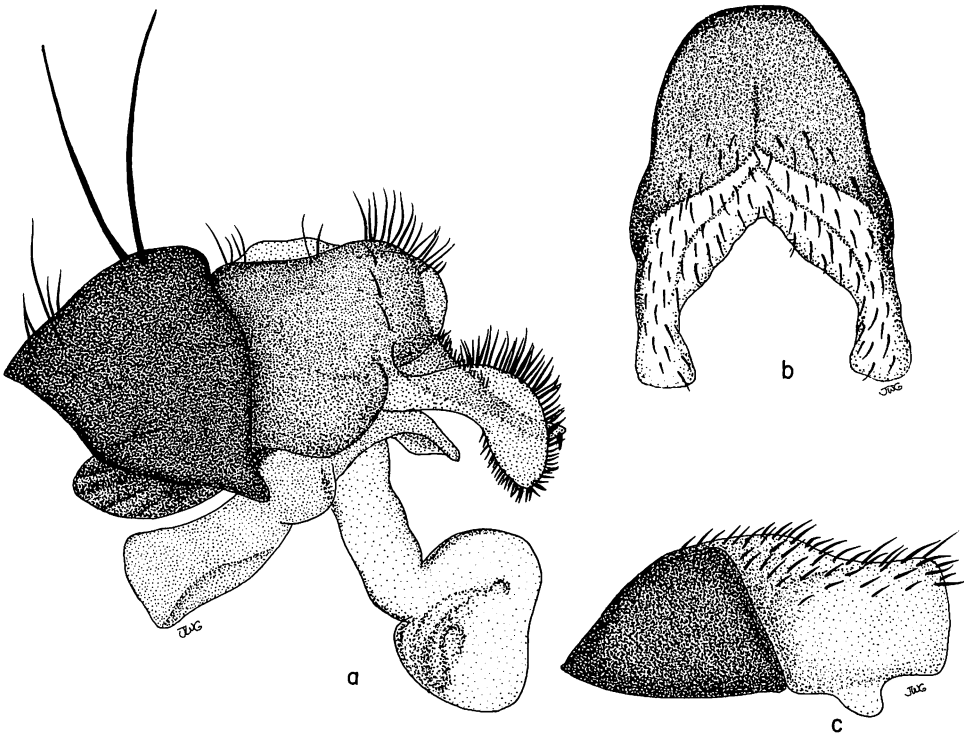


Figure 50—*Lispocephala rudis* (Grimshaw): a, male genitalia, lateral; b, fifth sternum, ventral; c, fifth sternum, lateral.

and 4-5 in male. Parafrontalia gray, frontal triangle gray with a faint tinge of gold and extending to about level with upper inferior fronto-orbital bristles. Interfrontal area rufous below, dull black above. Two basal segments of antennae yellow to rufous, tinged with brown. Third segment black on apical two-thirds, yellow basally. Aristae black. Legs entirely yellow, the chaetotaxy fitting that of most of the alakaiae group. Thorax and abdomen densely gray pollinose, abdomen lacking paired spots. Calypters faint yellow. Wings lightly infuscated. Crossvein r-m at middle of 1st M₂. Posterior portion of fifth sternum of male yellow, strongly lobate (50b) and, as seen in lateral view, the lobes are almost truncate (50c). The extension from the cercus is narrow, with a pair of strong, subapical, ventral teeth. Surstyli strongly arched upward on dorsal margins, narrowed basally and with outer surface almost bare and the inner, upper, surface setose. Other genital characters as in figure 50a.

Length of body, 4.0-4.5 mm.

Lispocephala silvicola Hardy, new species (figs. 51a,b)

Fitting in the alakaiae group, in the subgroup with dark reddish brown to black legs. It fits the parydra complex of species by having the palpi yellow, the wings brown colored, and the calypters dark fumose, the rims brown.

It fits very close to *parydra* and the only differentiating characters which I see are in the male genitalia. The male surstyli are strongly narrowed basally and highly arched on dorsal margins (fig. 51a), the fifth sternum has a V-shaped cleft on hind margin and the apical lobes are rounded (fig. 51b). The other genital characters are as in figure 51a. Otherwise fitting the description of *parydra*.

Length of body and wings, 5.8-6.4 mm.

Holotype male, allotype female, and two male paratypes: upper Hana Forest, Maui, 5,600 ft., December 8, 1973 (C. W. Whittle).

The immature stages of the species are very probably aquatic.

Type and allotype in B. P. Bishop Museum. Paratypes in University of Hawaii collection.

Lispocephala striata (Grimshaw) (figs. 52a-e)

Coenosia striata Grimshaw, 1901, Fauna Haw. 3(1):38.

Oahu (type-locality: Kawailoa Gulch). Type female in British Museum (Natural History).

Belonging in the alakaiae group in the complex of species which have the thorax black in ground color and the legs yellow. It fits near *perflava* n. sp., from Molokai, by lacking posterodorsal and anterodorsal bristles basad of middle of segment of hind tibia (fig. 52b). It differs by having antennae and body mostly dark brown to black; third antennal segment more elongate (fig. 52c); two pairs of strong presutural dorsocentrals; as well as other details. The elongate third antennal segment is rather similar to *macrocera* n. sp., but these fit in completely different species groups.

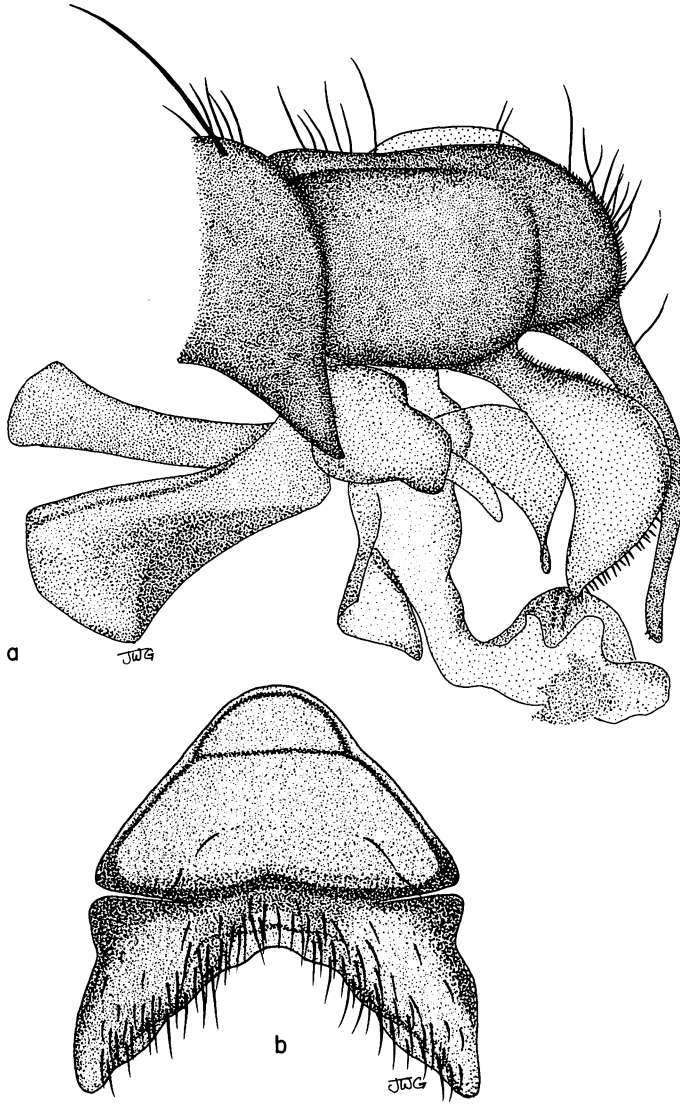


Figure 51—*Lispocephala silvicola* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

A small gray brown species with distinct brown striations on mesonotum. *Head*: Slightly wider than high with interfrontalia rufous, tinged with brown and ocellar triangle extending about half the length of the front. The orbits and face are gray pollinose. Antennae tinged yellow to rufous; third segment rather elongate, extending almost to oral margin, especially in males. Palpi yellow. Mouthparts yellow, tinged with brown. *Thorax*: Mesonotum largely brown with four gray vittae extending approximately to a level with posterior dor-

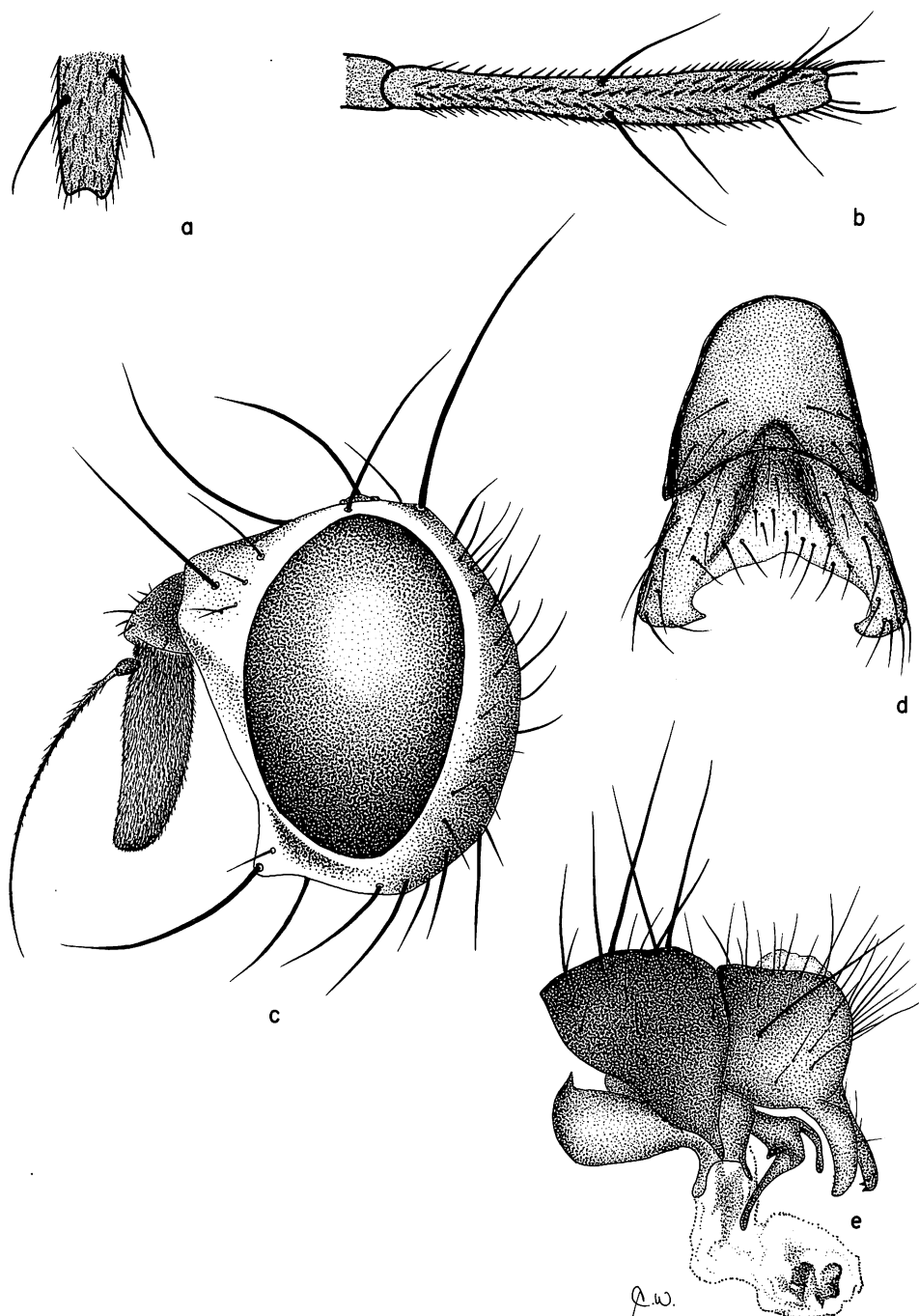


Figure 52—*Lispocephala striata* (Grimshaw): a, apex of hind femur, dorsal; b, hind tibia, dorsal; c, head, lateral; d, fifth sternum of male; e, male genitalia, lateral.

socentral bristles. Two pairs intraalars present. *Legs*: Yellow, except for discolorations of brown on upper apical portions of mid and hind femora and with the tarsi brown to black. Front tarsi slender, with basitarsus $2/3$ as long as tibia and entire tarsus equal to or slightly longer than head and thorax combined. One anteroventral bristle at apical $2/3$ of hind tibia. Bristles of dorsal surface of hind tibia as in figure 52b with preapical dorsal rather short, and apex of hind femur as in figure 52a. *Wings*: Light brown fumose, crossvein r-m situated slightly before middle of cell 1st M_2 . Abdomen mostly brown, lightly gray pollinose, with apices of terga 2–4 narrowly yellow-gray, and sides of first two terga broadly yellow. Fifth sternum lacking bristles but covered with numerous short setae and shaped as in figure 52d. Extensions from cercus with black preapical ventral dentations and other details of genitalia as in figure 52e.

Length of body, 3.75–4.5 mm.

***Lispocephala swezeyi* Hardy, new species (figs. 53a–d)**

This species apparently belongs in the *alakaiae* group which is characterized by lacking distinct dorsal bristles on hind femora but I am unable to relate it to any other species of *Lispocephala*. It has two bristles situated in approximately a dorsal position (slightly posterior of dorsal) (fig. 53d) but the usual posterodorsal bristle is lacking. The male genitalia are very distinctive, characterized by having the extension from the cercus spear-head shaped as seen in dorsal view and devoid of ventral setae except for minute preapical spinules on venter and surstyli strongly arched, almost boomerang-shaped (fig. 53a). Fifth sternum very broad compared to other *Lispocephala* I have studied, wider than long with a broadly U-shaped concavity on hind margin (fig. 53c).

Head: Distinctly wider than long with the front, measured from median ocellus to anterior margin, as wide as long. Interfrontal area dull brownish red. Ocellar triangle, vertex, and parafrontalia, also upper portions of parafacialia, yellow-brown pollinose. Ocellar triangle extending about half the length of the front. Antennae brown to blackish, rufous at extreme apex of second segment and extreme inner base of third. Aristae short plumose. Palpi entirely yellow, upper margin straight and lower margin gently convex and with prominent brown to black setae along ventral margin and at apex. Mentum brown, tinged with red and labella yellow. *Thorax*: Dark brown to blackish, tinged with rufous in ground color with mesonotum densely yellow-brown pollinose and sides gray. Mesonotum evenly yellow-brown pollinose, no indications of vittae or markings. Two pairs presutural dorsocentrals and two pairs of intraalars. Apical scutellars well developed, slightly longer than sub-basal pair. *Wings*: Evenly pale yellow-brown, r-m crossvein at middle of cell 1st M_2 . Calypters slightly yellowish, rims yellow-brown. *Legs*: Entirely yellow except for brown apical tarsomeres and a tinge of brown at apices of mid and hind femora. Front tibia lacking a median posterior bristle. Median posterior of middle tibia short, extending less than half the distance to apex of segment.

Bristles at apex of hind femur as in figure 53d; those of tibiae rather typical of most Hawaiian *Lispocephala* except that the single anteroventral bristle is located near apical fourth of the segment. *Abdomen*: Mostly brown, tinged with rufous in ground color especially on sides of terga 1-3. Fifth sternum unusually broad for Hawaiian *Lispocephala*, wider than long and with a broad U-shaped concavity on hind margin (fig. 53c). Extension from cercus and genitalia as seen in end view as in figure 53b. Genitalia as seen in lateral view (fig. 53a) and as noted in the introduction above.

Length of body, 4.25 mm.

FEMALE. Unknown.

Holotype male: Kohala Mts., Hawaii, May 24, 1917 (O. H. Swezey).

Type in B. P. Bishop Museum.

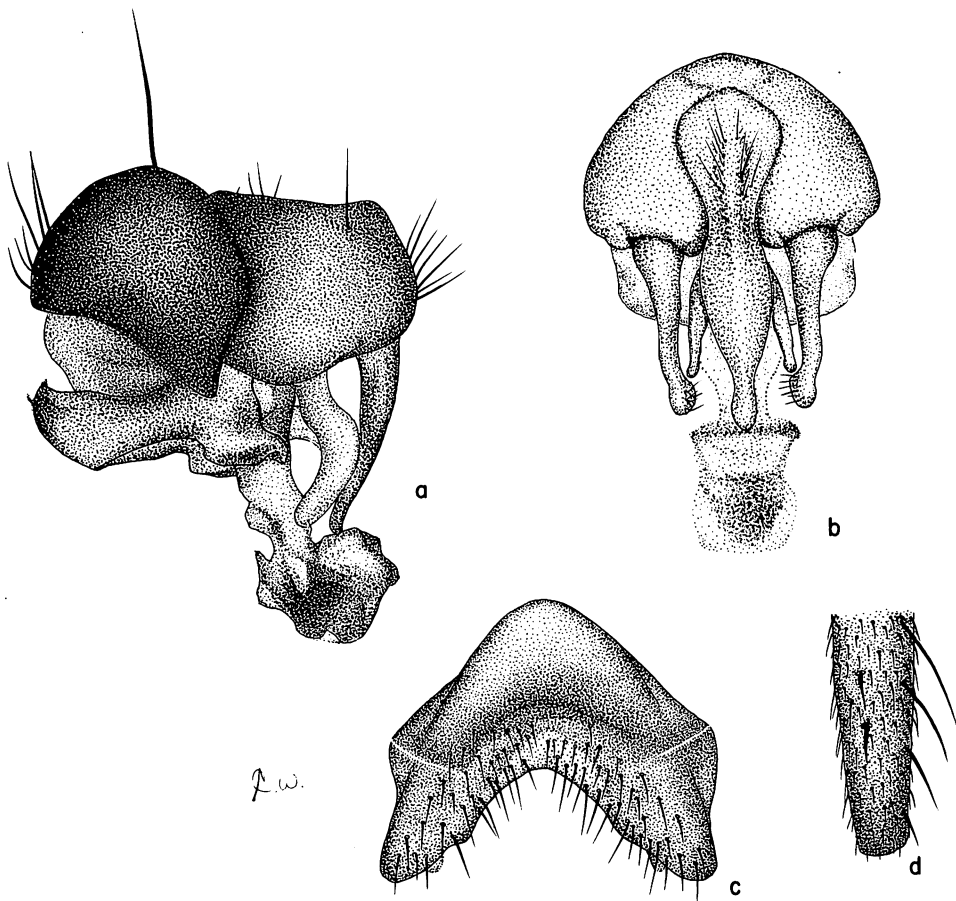


Figure 53—*Lispocephala swezeyi* n. sp.: a, male genitalia, lateral; b, male genitalia, end view; c, fifth sternum of male; d, apex of hind femur, dorsal.

It is a pleasure to name this species after the late O. H. Swezey who was one of the pioneer entomologists in Hawaii and who made a great many contributions to our understanding of the endemic fauna.

***Lispocephala tridentata* Hardy, new species (figs. 54a,b)**

Fitting in the *alakaiae* species group which lacks preapical dorsal bristles on hind femora, very near *dentata* n. sp. and fitting the description of that species except for the male terminalia. It is readily differentiated by having the fifth sternum more elongate, one-half longer than fourth and with a moderately deep V-shaped concavity on hind margin (fig. 54a), rather than fifth about equal or slightly shorter than fourth, with short, thick, apical lobes separated by a shallow concavity (fig. 38b). By the surstyli being concave on ventral margins, gently narrowed to apices, not broader than cerci, rather than with ventral margins convex, thickened, broader than surstylus. The parameres slender, sickle-shaped (fig. 54b), rather than straight, strongly tapered to sharp-pointed apices (fig. 38a). Also, the aedeagus differs as shown in the figures 54b, and 38a.

Length of body: male, 2.75–3.0 mm.; female, 3.3 mm.

FEMALE. Fitting description of *dentata*.

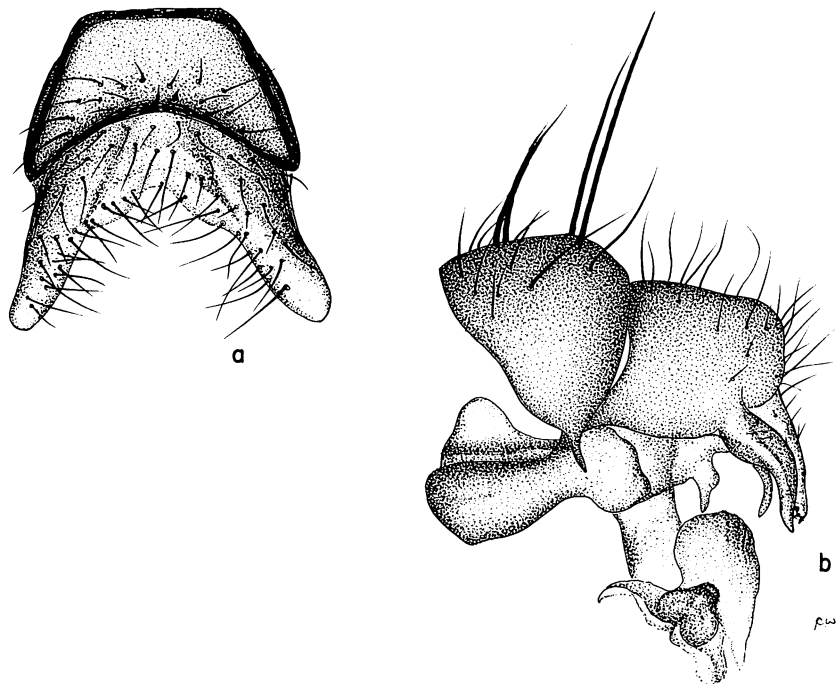


Figure 54—*Lispocephala tridentata* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

Holotype male: above Waikolu Valley, Molokai, 1,400 m., April 30, 1955 (E. J. Ford, Jr.). Allotype female and two female paratypes, Pepeopae, Molokai, April 25, 1964 (D. E. Hardy). Two female paratypes, same data as allotype, one collected July 30, 1959.

Type and allotype in B. P. Bishop Museum. Paratypes in University of Hawaii collection.

***Lispocephala whittlei* Hardy, new species (figs. 55a-e)**

This fits in the group characterized by lacking median posteriors on front tibiae and preapical dorsals on hind femora. It fits near *deceptiva* n. sp., but the male genitalia are distinctly different in the two (compare figures 37a-c and 55a-d). The fifth sternum has a small basal lobe as seen in lateral view (fig. 55c). The extension from the cercus is short and thick, with numerous spicules over the basal portion, and the parameres are strongly curved, hook-like (fig. 55a). In *deceptiva* the extension from cercus is rather slender, curved upward, scarcely thickened basally and lacking spicules, and the parameres much more slender, gently curved (fig. 37c). The third antennal segment of the male is also distinctly larger in *whittlei*, extending almost to oral margin and approaching the condition found in the species *macrocera* n. sp. These two are not related, the latter falls in the group which have only two well-developed scutellars and the genitalia and other details are very different.

MALE. Head: Just slightly wider than long as seen in direct frontal view and almost borderlining between the groups with comparatively broad head and those with rather narrow head, but the front is broad as is typical of the former group. Measured from median ocellus to anterior margin, it is about as wide as long. Interfrontal area mostly opaque black, with a tinge of rufous over the lower median portion. Ocellar triangle and vertex mostly brown pollinose and also with a narrow line of brown pollen along inner margin of each parafrontalia; remainder of parafrontalia gray pollinose. Face golden-gray pollinose. Ocellar triangle extending just slightly beyond level of lower superior fronto-orbitals. Antennae entirely black, third segment four times longer than wide and extending almost to anterior margin of face. Aristae long pubescent. Palpi yellow, rather slender, gently convex on ventral surface. Mentum dark brown to black, with a faint tinge of rufous in ground color. **Thorax:** Entirely black in ground color, gray on sides and mostly gray-brown pollinose over dorsum, with no distinct indications of vittae. Two pairs presutural dorsocentrals and two pairs intraalars. **Legs:** Mostly yellow with apices of hind femora broadly brown to blackish and all tarsi brown to black. Median posterior bristle of middle tibia extending about two-thirds the distance to apex of segment and hind tibia with one strong anteroventral just beyond middle. No preapical dorsal bristles on hind femora (fig. 55e). **Wings:** Lightly infuscated, smoky. Cross-vein r-m at middle of cell 1st M₂. Calypters entirely white, faintly yellowish on the rims. **Abdomen:** Basal three terga yellow on sides, broadly black over median portions. Remainder of abdomen entirely black, moderately gray

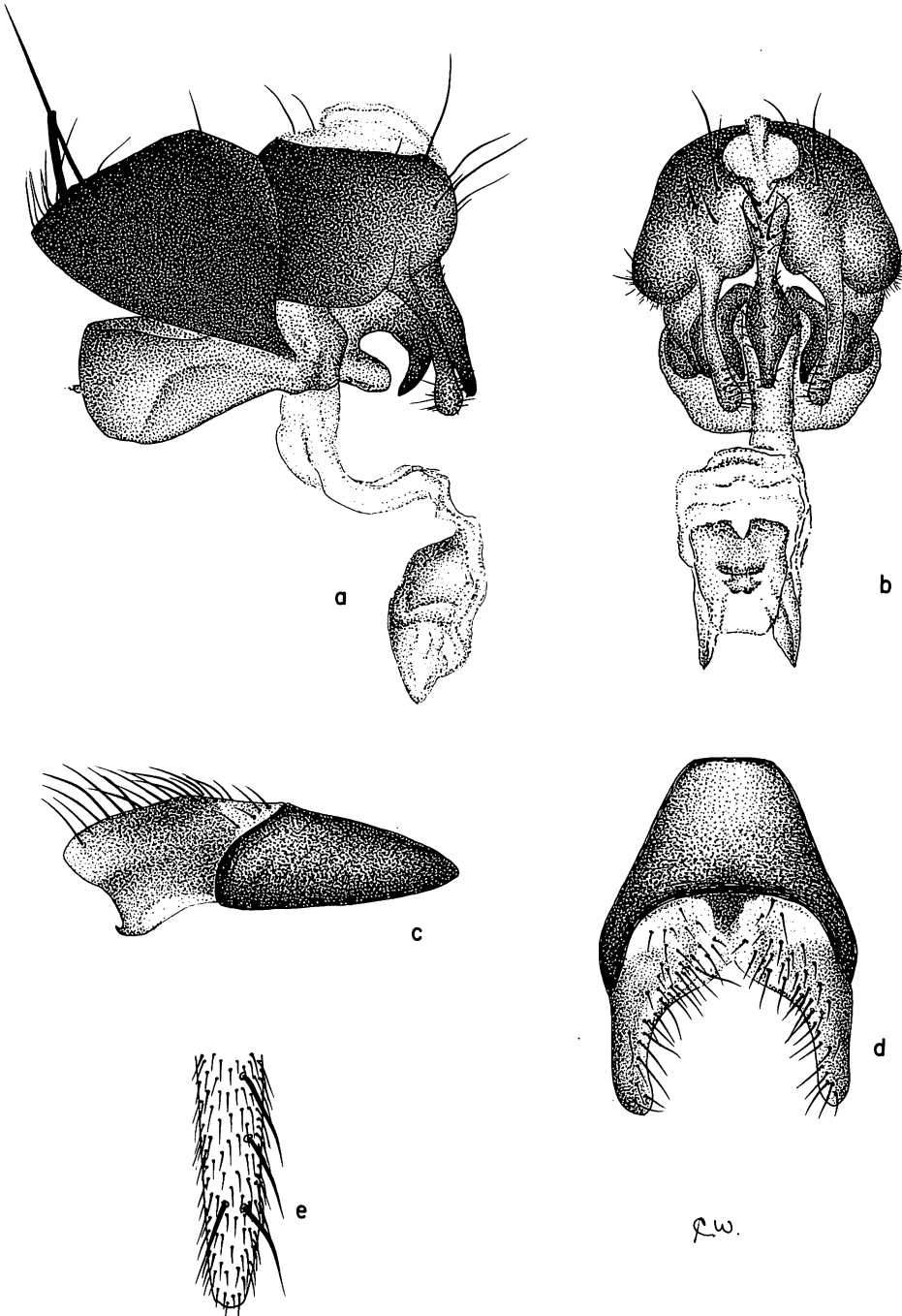


Figure 55—*Lispocephala whitlei* n. sp.: a, male genitalia, lateral; b, genitalia, end view; c, fifth sternum of male, lateral; d, fifth sternum, ventral; e, apical portion of hind femur, dorsal.

pollinose with narrow gray apices on terga 2, 3, and 4. No paired spots present on terga. Genitalia as described above and as in figures 55a-d.

Length of body, 5.5 mm.

FEMALE. Fits description of male in most respects, although the third antennal segment is not so well developed, more normal in shape.

Length of body, 7.0 mm.

Holotype male, allotype female, and four paratypes (two males, two females): Koolau Forest, Maui, 6,500 ft., July 30, 1973 (C. Whittle).

Type, allotype in B. P. Bishop Museum. Paratypes in collections of the U.S. National Museum and the University of Hawaii.

This species is named after Mr. Charles Whittle, who was the entomologist on the National Science Foundation, Student Organized Studies Program during the summer and fall of 1973. Mr. Whittle was the pioneer worker on the insects of this previously biologically unknown region of the wet northern slopes of Haleakala. He collected a great many new species and gained a great deal of biological information over a period of approximately five months spent in this fabulous region.

CONFLUENS SUBGROUP

Differentiated from the alakaiae subgroup by having one or more preapical dorsal bristles situated near apical fifth of the hind femora, in addition to having antero- and posterodorsals present (figs. 58d, 65a).

Apparently many of the species of this subgroup have very similar male genitalia with slender cerci and surstyli (fig. 58a) and a rather deep V-shaped cleft on hind margin of fifth sternum (fig. 58b). *L. montgomeryi* n. sp., *brunnei-pennis* n. sp., and *obscura* n. sp. form a species complex by having the extension from cercus swollen basally below, nearly bare with one or more preapical spinules (fig. 67c) and the surstyli nearly straight-sided, blunt apically (fig. 56b).

***Lispocephala brunneipennis* Hardy, new species (figs. 56a,b)**

Fitting in the subgroup which has preapical dorsal bristles on the hind femora and in the *montgomeryi* complex of species by having the femora entirely dark brown to black, palpi all yellow, two anteroventral bristles on hind tibia and only one preapical dorsal bristle on femur. It would differ from other species with this combination of characters by having the calypters dark fumose, rims brown; wings brown fumose; frontal triangle short, extending only to about upper pair of inferior fronto-orbitals, and the fifth sternum and male genitalia distinctive as in figures 56a,b.

MALE. Rather small, mostly dark-colored species. *Head*: Front mostly brown, the interfrontal area scarcely differentiated from the yellow-brown ocellar triangle and parafacialia. Antennae all brown, except for a tinge of rufous on inner basal portion of third segment. Aristae moderately plumose, the longest hairs equal to two-thirds the width of third segment. *Thorax*: Evenly brown pollinose over dorsum, gray on sides, and with humeri and narrow lat-

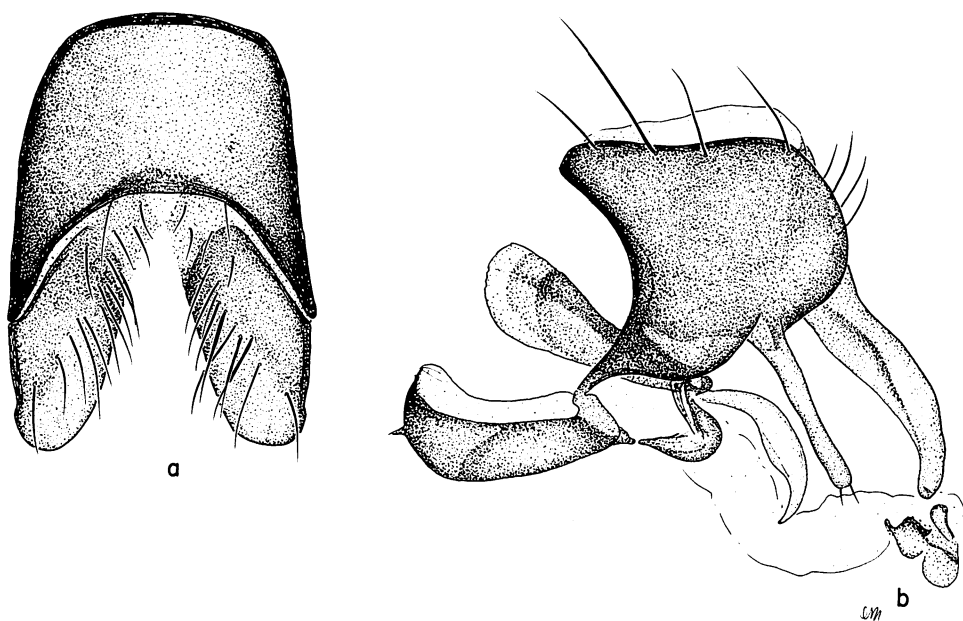


Figure 56—*Lispocephala brunneipennis* n. sp.: a, fifth sternum of male; b, male genitalia, ventral.

eral margins of mesonotum gray. *Legs*: Femora dark reddish brown to blackish, tibiae yellow, and tarsi tinged brown to blackish. Bristle characters as noted above. *Wings*: Evenly pale brown fumose. I see nothing distinctive about the venation. Calypters pale brown, distinctly so on rims. *Abdomen*: Mostly shining dark brown to black in ground color, lightly gray-brown pollinose and with no indications of paired spots on the terga. Fifth sternum with broad rounded lobes as in figure 56a and genitalia as in figure 56b, with the surstyli very slender, straight-sided, and each bearing two setae at apex, and the extension from cercus almost devoid of short setae except for the preapical ventral spinules.

Length: body, 4.2–4.5 mm.; wings, 3.75–4.0 mm.

FEMALE. Unknown.

Holotype male: Hawaii National Park, 4,000 ft., August 1952, collected at light (H. A. Bess). Five male paratypes from following localities on Hawaii, same data as type: Humuula, August 3, 1935 (R. L. Usinger); Kilauea Forest, Mauna Loa, 5,300 ft., June 21, 1971 (D. E. Hardy); and Bird Park, Kilauea, May 15, 1972 (D. E. Hardy).

Type and one paratype in B. P. Bishop Museum. Other paratypes in collections of U.S. National Museum and the University of Hawaii.

Lispocephala carita Hardy, new species (fig. 57)

Fitting the confluens subgroup which have preapical dorsal bristles on hind femora and close to *triangulifera* (Grimshaw), from Hawaii. Differing by having

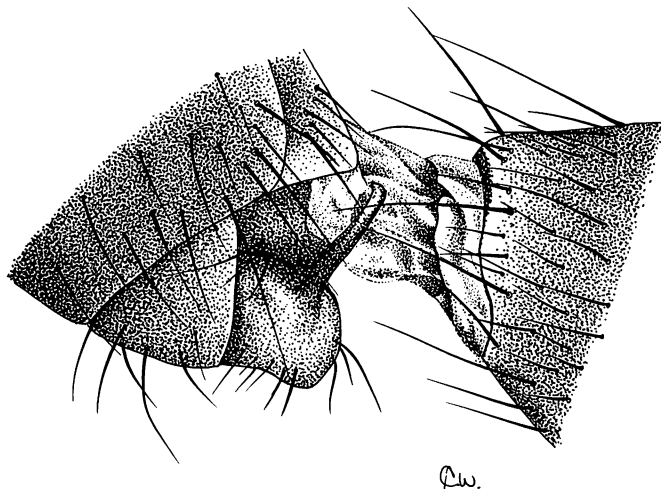


Figure 57—*Lispocephala carita* n. sp.: male and female in copula, apices of abdomens.

the mid and hind femora broadly black on the apical one-half to two-thirds; thorax gray with median portion of mesonotum broadly brown pollinose and terga 3-5 in male and all terga of female mostly dark brown to black bordered with gray posteriorly and on sides, with no paired spots present.

MALE. Fitting the general characteristics of *triangulifera* except that the thorax is gray pollinose rather than yellow-gray and the mesonotum is predominantly brown, except for the gray on anterior margins and broadly gray on sides. Also, the scutellum is brown pollinose, except for the gray margins and venter. *Head:* Front largely brownish yellow, the interfrontalia reddish brown to black in ground color, rather lightly gray pollinose. The ocellar triangle extends almost to anterior median margin of front. Antennae almost entirely black, rufous at extreme apices of second segment. Aristae short plumose. *Thorax:* Both intraalar bristles well developed. *Legs:* Yellow, except apical three-fifths to two-thirds of hind femur black, densely gray pollinose and apical half of mid femur blackened. Also front femur with a tinge of brown to black on upper apical portion. Two strong preapical dorsal bristles on hind femur and two anteroventral on hind tibia. *Wings:* Subhyaline. I see nothing distinctive about the venation. Calypters yellow-white. *Abdomen:* Broadly yellow on sides of first three terga, brown to black over median portions of these segments. Remainder of abdomen shining black in ground color, predominantly dark brown pollinose, with posterior and lateral margins of terga gray. The genitalia have not been dissected for study. In copula they appear as in figure 57; the surstyli are long and slender.

Length of body, 5.0 mm.

FEMALE. Fitting the characteristics of the male in most respects except that the abdomen is almost entirely black as seen from direct dorsal view, only sides

of first two terga are broadly yellow and the third is narrowly yellow. The terga are almost entirely opaque pollinose, narrowly gray on anterior and posterior margins.

Length of body, 6.0–6.25 mm.

Holotype male and allotype female, *in copula*: Hanaula, West Maui, 4,000 ft., July 10, 1968 (J. A. Tenorio). A series of six females from Upper Hana Forest, Maui, 5,600–7,100 ft., August–December 1973 (C. W. Whittle and S. L. Montgomery), and from Hanawi Ridge Trail, Maui, August 1973 (S. L. Montgomery) seem to fit here but the mid femora are all yellow.

Type and allotype in B. P. Bishop Museum.

***Lispocephala confluens* Malloch (58a–d)**

Lispocephala confluens Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):79.

Maui (type-locality: "Maui, July 9, 1919"), Molokai, and probably Hawaii.

This species fits in the *alakaiae* group and the *confluens* subgroup and is characterized by having three anteroventral bristles on hind tibia; femora predominantly yellow to rufous, typically with apices of the hind pair and often mid pair broadly brown to black; mesonotum conspicuously marked with brown pollen; paired, black spots on terga 3–4 in female and 3–5 in male, as seen in end view, and arista moderately plumose, with the longest hairs equal to about two-thirds the width of third antennal segment.

Fitting very near *subvittata* Malloch and *triangulifera* (Grimshaw), from Hawaii, but differs by typically having three anteroventral bristles on hind tibia; the male surstyli with the ventral setae in median portion widely separated from preapical ventral spinules, not confluent, and the parameres rather broad (fig. 58a). The number of anteroventrals on the hind tibia may be variable from two to four, with the vast majority having three. It fits closest to *triangulifera* and some specimens on hand, from Hawaii, do have three anteroventrals. The only apparent differences I see are in the genital characters mentioned above. Head as in figure 58c and fifth sternum of male as in figure 58b.

It is also very close to *paloloae* Malloch from Oahu, which is differentiated by the all yellow legs, gray mesonotum, and by having only two anteroventral bristles on hind tibia. Much more biological data is needed before clear species concepts can be formulated for various of these closely related *Lispocephala*.

A large series of specimens have been studied and these exhibit a considerable range of variation in pollinosity of the mesonotum and in leg coloration. Two intraalar bristles are present and typically the mesonotum and scutellum are brown pollinose, contrasting from gray pollen on humeri and lateral margins of mesonotum. The extent of the brown pollinosity on mesonotum appears variable and is sometimes confined to broad streaks down dorsocentral lines or to the area between the dorsocentral rows. It is possible that some specimens of this species may have the mesonotum entirely gray and

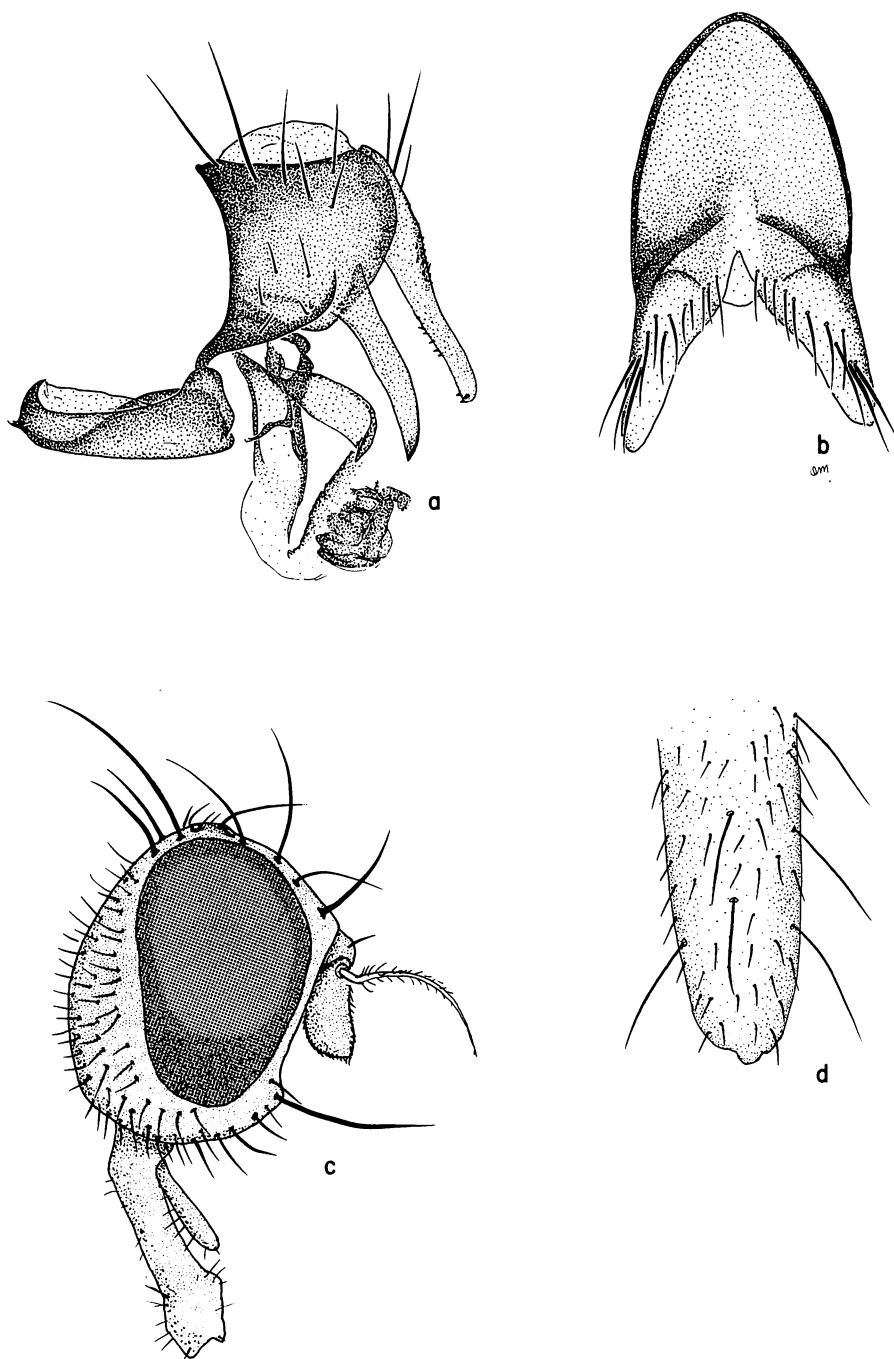


Figure 58—*Lispocephala confluens* Malloch: a, male genitalia, lateral; b, fifth sternum of male; c, head, lateral; d, apex of hind femur, dorsal.

this character alone would not appear to be diagnostic. The hind femur has two (fig. 58d) or three preapical dorsal bristles.

Length of body, 5.0–7.0 mm.

***Lispocephala expulsa* Hardy, new species (figs. 59a–c)**

Fitting in the *alakaiae* group in the *confluens* subgroup which have two preapical dorsal bristles on hind femur and two anteroventrals on hind tibia. Fitting very near *triangulifera* (Grimshaw) but differing by being smaller and by the fifth sternum and genitalia of male being different in development (figs. 59a, 72a). The lobes of the fifth sternum are truncate apically as seen in lateral view (fig. 59b); the ventral setae in middle of the extension from cercus are widely spaced from the preapical ventral spinules, and the surstyli are distinctly bent downward apically. In *triangulifera* the lobes of the fifth sternum are rounded apically, the ventral setae on extension from cercus are confluent with the ventral spinules, and the surstyli are almost straight. Also, the hind femora

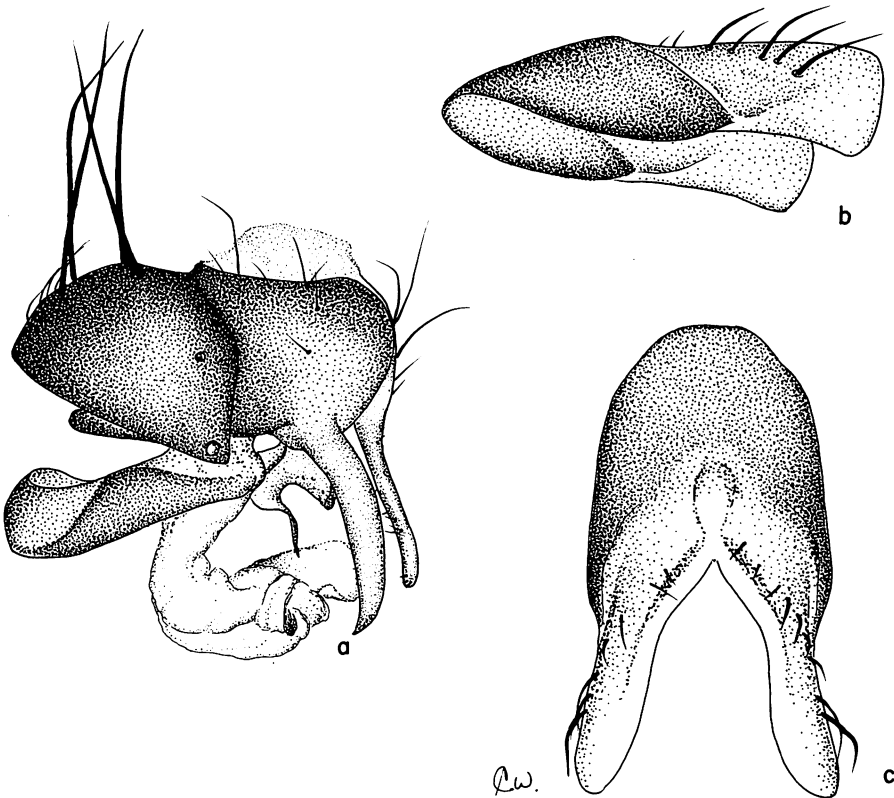


Figure 59—*Lispocephala expulsa* n. sp.: a, male genitalia, lateral; b, fifth sternum, lateral; c, fifth sternum of male, ventral.

are broadly brown to black in *expulsa*, whereas in most *triangulifera* the middle femora are entirely yellow.

MALE. Fitting the description of *triangulifera* except for the above mentioned characters. *Head:* Interfrontalia dull black, except for a tinge of rufous along lower margin. Ocellar triangle extending almost to anterior median margin of front. Base of third antennal segment broadly yellow and apical portion of second yellow. Third segment comparatively short, two times longer than second, measured on dorsum along longitudinal seam. Aristae moderately plumose, the longest hairs are scarcely more than width of third antennal segment. Palpi entirely yellow, rather short, about one half as long as mouth parts, and scarcely expanded apically. *Thorax:* Entirely gray pollinose except for faint indications of brown vittae down dorsocentral rows. Two pairs of strong presutural dorsocentrals and two pairs of prominent intraalar bristles present. *Wings:* Entirely hyaline, r-m crossvein at middle of cell 1st M₂. Calypters entirely white, including the fringe. *Legs:* Mostly yellow with the apical fourth of mid-femur and apical two-fifths of hind dark brown to black. Bristle characters as in *triangulifera* with two pairs anteroventrals on hind tibia, located near apical third of segment. *Abdomen:* As in *triangulifera*. Fifth sternum and genitalia as noted above and as in figures 59a-c.

Length of body, 4.0 mm.

FEMALE. Unknown.

Holotype male: Kolekole Pass, Oahu, 1,725 ft., December 27, 1966 (J. R. Vockeroth).

Type in Canada Department of Agriculture collection, Ottawa.

***Lispocephala flavobasalis* (Grimshaw) (figs. 60a-d)**

Coenosia flavobasalis Grimshaw, 1901, Fauna Hawaïiensis 3(1):32.

Hawaii (type-locality: Olaa). Also possibly on all of the main islands.

Type male in British Museum (Natural History).

A large series of specimens on hand may represent a single species which is widespread over the islands or a complex of closely related species. This belongs in the confluens subgroup and is characterized by having the antennae all yellow, the mesonotum entirely gray pollinose, apex of hind femur brown, and with the anteroventral bristles of hind tibia and preapical dorsals of hind femur variable; typically in the combination of one anteroventral and two preapical dorsals but sometimes with two anteroventrals and one preapical dorsal. I am unable to find any reliable genital differences in these populations from different islands. Closely resembling *triangulifera* (Grimshaw), but with antennae yellow and usually only one anteroventral bristle on hind tibia. Typical *flavobasalis*, based upon the type male and a large series of specimens from upper Olaa, Kilauea, and other areas of the island of Hawaii, is a medium-sized species with antennae, palpi, and legs yellow, except for brown to blackish apices of hind femora and tarsi. In some female specimens the dorsoapical portion of the third antennal segment is tinged with brown. Also, basal three segments of abdomen yellow, except for brown markings on

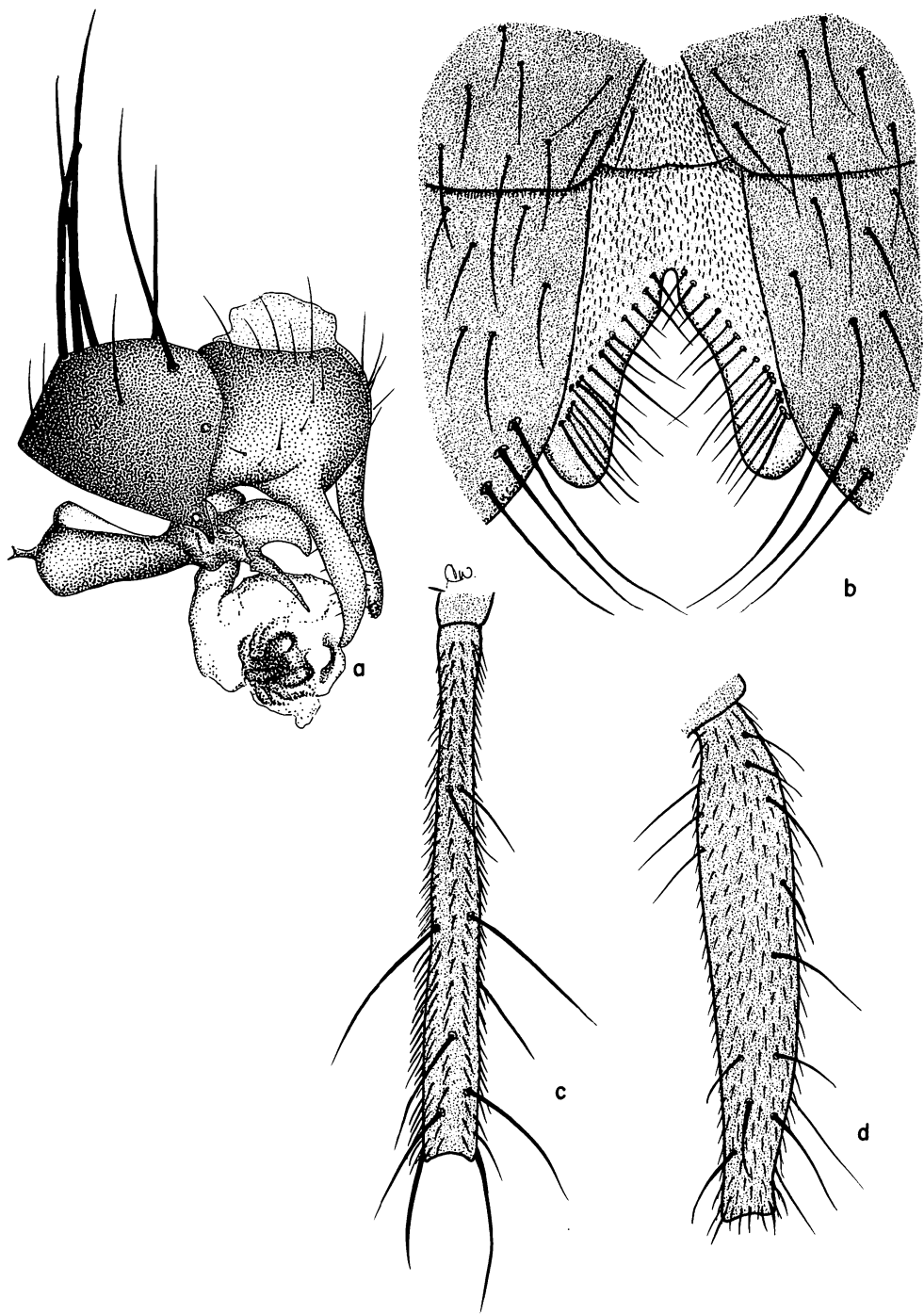


Figure 60—*Lispocephala flavobasalis* (Grimshaw): a, male genitalia, lateral; b, fifth sternum and sides of fourth and fifth terga of male, ventral; c, hind tibia, dorsal; d, hind femur, dorsal.

posteromedian portions of terga 2 and 3. Front gray pollinose with the rufous ground color of the interfrontal area almost obscured and with frontal triangle extending almost to anterior margin. Five pairs of strong dorsocentrals are present, the anterior intraalars are well developed. Calypters entirely white, with the upper extending about half the length of the lower. Wings hyaline with r-m crossvein situated at middle of cell 1st M_2 and last section of vein $M_1 + 2$ less than two times longer than penultimate section. Bristles of mid tibia as in figure 60c. Hind femora each with two strong preapical dorsal bristles (fig. 60d) and tibia with one anteroventral situated near apical two-thirds of segment. The posterior half of abdomen rather densely gray pollinose and terga 3-5 have conspicuous, subshining, brown, paired spots. The fifth sternum is as in figure 60b. The male genitalia are as in figure 60a.

A few specimens (5) are on hand from the island of Hawaii which have two anteroventral bristles on hind tibia, a second bristle is present near middle of segment in addition to the strong bristle at apical three-fifths-two-thirds. One female specimen on hand from Kauai runs to *flavobasalis* but very probably represents a distinct species. This may possibly be an aberrant specimen of *kauaiensis* (Grimshaw).

***Lispocephala flavobasalis* *extera* Hardy, new subspecies**

A form of this species, probably a subspecies or very possibly a distinct species occurs on Molokai and Maui which has the hind femora entirely yellow. I see no other characters which will differentiate these populations, but, on the basis of our experience with Hawaiian *Drosophila* in which it has been demonstrated that the species are very highly island endemic and in which in each case of "species," which have been recorded from two or more islands and have been investigated thoroughly, they have turned out to be species complexes, it is highly probable that many, if not most, of the *Lispocephala* which now appear to be rather widely distributed will prove to represent species complexes. The series on hand from Molokai and Maui consistently have two anteroventral bristles on hind tibia whereas typical *flavobasalis* have only one. It has been demonstrated, however, that this character is not completely reliable. Also, in most of the specimens from Molokai and Maui, the acrostichal setae are arranged in transverse rows and two prescutellar setae were present; the post-vertical bristles are usually almost in line with the inner verticals. In most specimens of *flavobasalis*, from Hawaii, the acrostichal setae are irregularly placed and not arranged in transverse rows; also, three prescutellars are usually present and the postocellars are situated well behind the inner verticals. These characters do not appear to be reliable and it is doubtful that they represent species differences. It will be necessary to study a larger series of specimens from Molokai-Maui and, if possible, to obtain biological data in order to ascertain the true status of these populations. I find a rather wide range of variability in the genital characters and see no diagnostic characters for separating these.

Holotype male: Kamoku, Molokai, July 19, 1963 (D. E. Hardy). Allotype

female: Kawela Gulch, Molokai, 2,900 ft., July 14, 1971 (S. L. Montgomery). Fourteen paratypes, 3 males and 11 females, from the following localities: Molokai—same as type and allotype; S. Ridge of Halawa Valley, June 29, 1967 (K. Y. Kaneshiro); Kainalu, July 28, 1927, 2,000–3,000 ft. (E. H. Bryan, Jr.); Kahuaawi Gulch, July 1952 (D. E. Hardy); Puu Kolehale, June 9, 1971 (M. D. Delfinado); Maunawainui Valley, July 1952 (D. E. Hardy) and above Waikolu Valley, 1,400 m., May 2, 1955 (E. J. Ford). Maui—Keanae Valley, 1,600 ft., December 28, 1966 (D. E. Hardy); and Haelaau, December 18, 1928 (O. H. Swezey).

Type, allotype, and some paratypes in B. P. Bishop Museum. Other paratypes in collections of the U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala flexa* Hardy, new species (figs. 61 a,b)**

Fitting in the confluens subgroup near *confluens* Malloch and *triangulifera* (Grimshaw), but differing by having the antennae rufous and the extension from the male cercus bent downward apically (fig. 61a).

Fitting the description of *confluens* in all respects except for the features noted

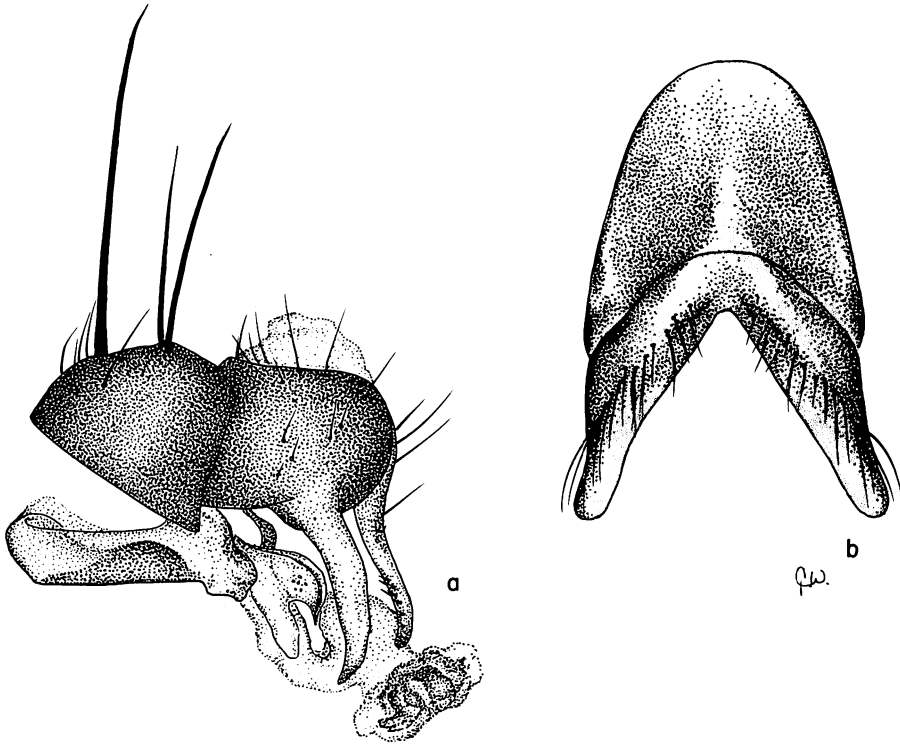


Figure 61—*Lispocephala flexa* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

above and having three anteroventral bristles on hind tibia. The arista is moderately long plumose, the longest hairs are equal in length to the width of third antennal segment. Ocellar triangle not extending to anterior margin of front, ending but one third the distance from upper to lower inferior fronto-orbital bristles. Mesonotum mostly gray with median portion indistinctly marked with brown between dorsocentral rows. Markings of abdomen as in *triangulifera*. Fifth sternum of male with the lobes rather broad, truncate apically as seen in lateral view and as in figure 61b, viewed from below. Male genitalia as in figure 61a.

Length of body, 4.5 mm.

FEMALE. Unknown.

Holotype male: Alakai Swamp, Kauai, 3,800 ft., July 28, 1963 (D. E. Hardy).

Type in B. P. Bishop Museum.

***Lispocephala fuscobrunnea* Malloch (figs. 62a-c)**

Lispocephala fuscobrunnea Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):80.

Hawaii (type-locality: Pahala). Also possibly on Maui.

Type female in B. P. Bishop Museum.

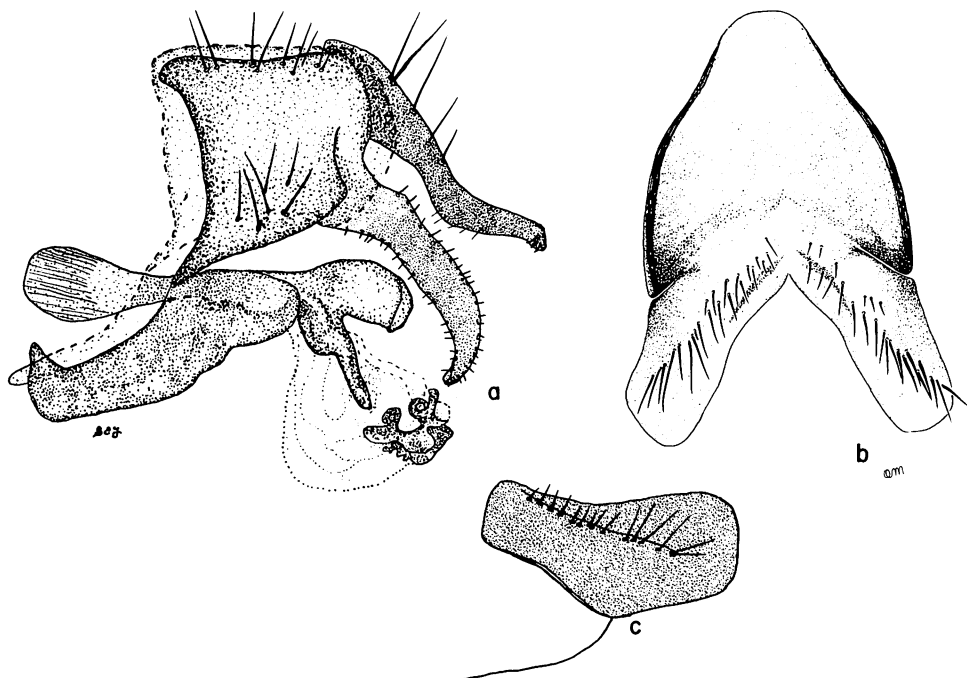


Figure 62—*Lispocephala fuscobrunnea* Malloch: a, male genitalia, lateral; b, fifth sternum of male; c, fifth sternum, lateral.

The males have not previously been recorded. A series of specimens are on hand from several localities on Hawaii. Also specimens from Haleakala, Maui appear to belong here.

Fitting in the confluens subgroup of species near *confluens* Malloch by having three anteroventral bristles on hind tibia in combination with strong preapical dorsals on hind femora and by the genital characters. It is readily differentiated by the predominantly dark-colored legs: femora all black or dark reddish-brown, tinged with black, and tibiae tinged brown to black. Also by having the palpi fuscous on apical halves and the calypters brown on rims, and third antennal segment entirely black, not broadly yellow to rufous on inner basal portion. It resembles *parilis* n. sp., from Maui and Molokai, but that species has the palpi all yellow; inner basal portion of third antennal segment yellow, calypters pale with yellowish rims, and the frontal triangle, parafrontals, parafacials gray and also the mesonotum and scutellum predominantly gray. In *fuscobrunnea* the frontal triangle, parafrontals, parafacials, and the entire mesonotum and dorsal portion of scutellum are brown pollinose with no gray markings. The male genitalia seem to be characterized by having the extension from the cercus curved upward and the surstyli curved downward (fig. 62a). The fifth sternum of the male has the lobes broad, nearly truncate apically (figs. 62b,c).

In addition to the above, the aristae are moderately plumose, the longest hairs equal to one-half to two-thirds the width of the third antennal segment. The anterior intraalars are well developed. Wings infuscated pale brownish. Calypters lightly infuscated, rims light brown. Abdomen mostly black in ground color, brown pollinose over dorsum, gray on lateral margins and narrow posterior margins of terga, and with paired subshining black spots on terga 3-5.

The presence of three anteroventral bristles on hind tibia is obviously not a reliable character, most of the specimens examined have three bristles but occasional specimens have only two.

Length of body, 5.5-7.0 mm.

***Lispocephala implumis* Hardy, new species (figs. 63a-c)**

Fitting in the alakaiae group and the confluens subgroup in a complex near *rufibasis* Malloch, from Molokai. Differing by being smaller, body, 4.5 mm. rather than 5.5-6.5 mm.; mesonotum broadly brown over median portion, not vittate; abdomen with continuous broad pollinose brown bands over terga, not interrupted with gray medianly, and male surstyli tapered and pointed apically.

MALE. *Head:* Wider than high and with ocellar triangle extending almost to anterior edge of front. Antennae black except for yellow inner bases of third segment and extreme apical margins of second segment. Arista almost bare, with only microscopic setae on basal portion. Palpi entirely yellow, gently clavate. Mentum shining dark brown to black. *Thorax:* Predominantly gray

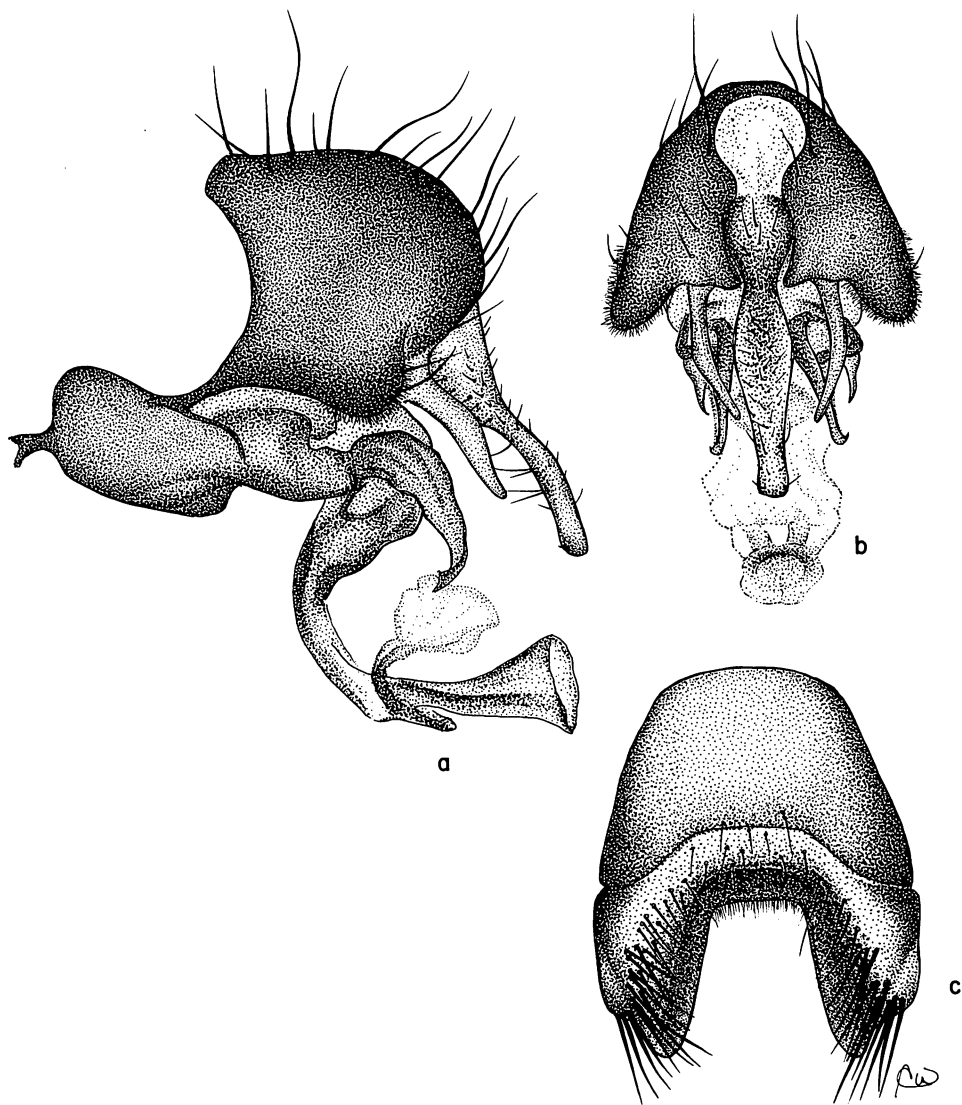


Figure 63—*Lispocephala implumis* n. sp.: a, male genitalia, lateral; b, genitalia, end view; c, fifth sternum of male.

pollinose, brown on mesonotum except on sides and anterior portion. Scutellum mostly gray, with some brown pollen around basal scutellars and sometimes across disc. Two strong presutural dorsocentrals and two strong intraalars. Halteres yellow. Calypters white with rims yellow, tinged lightly with brown. *Wings*: Distinctly tinged with brown, r-m crossvein at middle of cell 1st M_2 . *Legs*: Almost entirely dark brown to black in ground color, yellow at ex-

treme apices of femora and bases of tibiae. *Abdomen*: Seen from direct dorsal view, the terga are mostly brown pollinose with narrow bases and apices of terga gray. Sides of terga broadly gray. As seen from end view, large indistinct brown spots are visible on terga 3 and 4. Fifth sternum shaped as in figure 63c with a dense clump of short, black bristles on inner apical portion of each ventral lobe. Male genitalia as in figures 63a,b, the surstyli are slender, completely bare, and arise from the inner margin of each epandrium. The aedeagus has a large membranous flap on each side of dorsal margin at about mid length and the apical portion is tubular and expanded at tip, trumpet-shaped.

Length: body, 4.5 mm.; wings, 3.75 mm.

FEMALE. Fitting description of male except for sexual characters.

Holotype male: Poamoho Trail, Wahiawa, Oahu, 1,200 ft., February 17, 1961 (D. F. Hardwick). Allotype female: South Ridge Kipapa Gulch, Oahu, 2,200 ft., July 4, 1932 (E. Y. Hosaka). Two male paratypes, one same data as type and one Mount Tantalus, Oahu, 950 m., October 30, 1963 (D. M. Tsuda).

Type returned to Canada Department of Agriculture. Paratypes in collections of B. P. Bishop Museum and University of Hawaii.

***Lispocephala indecisa* Hardy, new species (figs. 64a,b)**

Fitting very near *paloloae* Malloch and differentiated by having the thorax entirely black in ground color, densely gray pollinose. The fifth sternum of the male is more elongate, distinctly longer than wide, and with the concavity on hind margin extending only one-third-two-fifths the length of the sclerite. Also, the lobes of the sternum are less extended beyond the lateral rows of setae or bristles (fig. 64b). The genitalia are as in figure 64a. I find no other characters for differentiating these.

Length of body: male, 5.25–5.5 mm.; female, 5.5–7.0 mm.

Holotype male and allotype female: Camp No. 1, Kipahulu Valley, Maui, 3,100 ft., August 9, 1967 (K. Y. Kaneshiro). Thirty-eight paratypes, 8 males and 30 females, from the following localities on Maui: (same as type) ridge above Kaulalewelewe, 3,000–4,000 ft., August 4, 1964 (D. E. Hardy); Puu Kukui Ridge, 3,000–3,500 ft., October 25–27, 1966–July 21, 1971 (D. E. Hardy and T. Saigusa); Keanae, July 1953 (C. R. Joyce); Hanaula, West Maui, 4,000 ft., July 9, 1968 and April 16, 1971 (J. A. Tenorio and S. L. Montgomery); Waikamoi, July 1966 and 1967 (J. P. Murphy, H. T. Spieth, and D. E. Hardy); and Auwahi, April 1972 (K. Y. Kaneshiro). Eight paratypes, 2 males and 6 females, from following localities on Molokai: Puu Kolekole, 1,180 m., January 14–June 9, 1971–1974 (M. D. Delfinado, S. L. Montgomery, and F. Howarth); Kainalu Gulch, April 9, 1963 (D. E. Hardy); and south of Hanalilolilo, April 13, 1966 (K. Y. Kaneshiro). Also one male paratype from Lanai Hale, Lanai, 3,300 ft., August 19, 1965 (D. E. Hardy).

A series of 19 specimens of both sexes is on hand from a number of localities

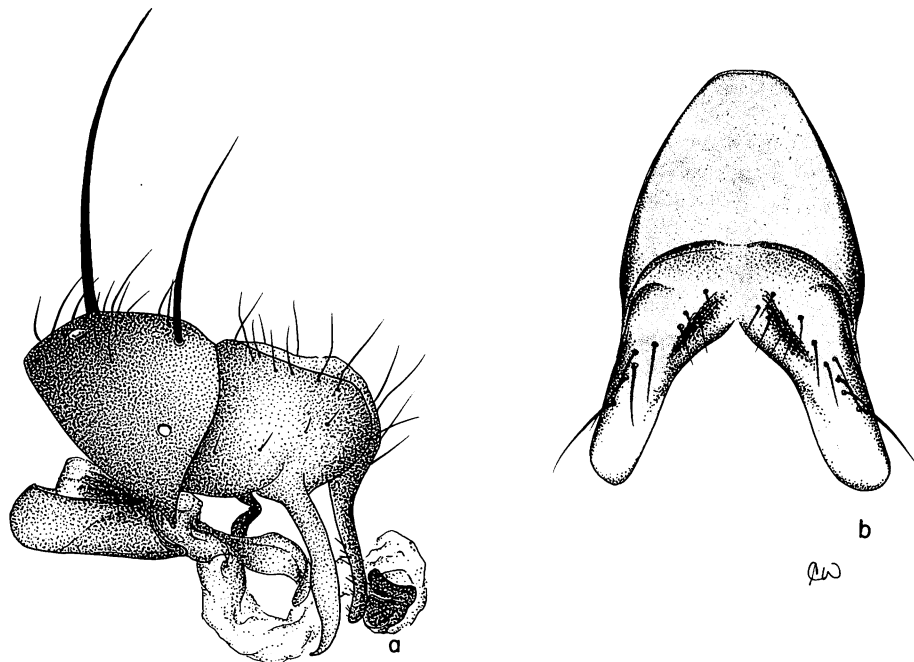


Figure 64—*Lispocephala indecisa* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

from the island of Hawaii. These appear to fit the characteristics of *indecisa* but may possibly represent a distinct species although at present differentiating characters cannot be found. These are not being designated as paratypes.

Type, allotype, and a series of paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of U.S. National Museum, British Museum (Natural History), Canada Department of Agriculture, and the University of Hawaii.

***Lispocephala kauaiensis* (Grimshaw) (figs. 65a, b)**

Coenosia kauaiensis Grimshaw, 1901, Fauna Hawaiiensis 3(1):37.

Kauai (type-locality: "Kauai, 4,000 ft."). Type male in British Museum (Natural History).

This species is known only from the type male. It appears to fit near *triangulifera* (Grimshaw), from Hawaii, and would seem to differ by having the thorax entirely gray pollinose, lacking brown vittae or markings. Also, Grimshaw stated in the original description that only one pair of presutural dorsocentrals are present. In my examination of the type, I had indicated in my notes that only one preapical dorsal bristle was present on the hind femur (fig. 65a); Mr. Adrian Pont, of the British Museum, has since re-examined the type and has found one preapical dorsal bristle on the left hind femur and two on

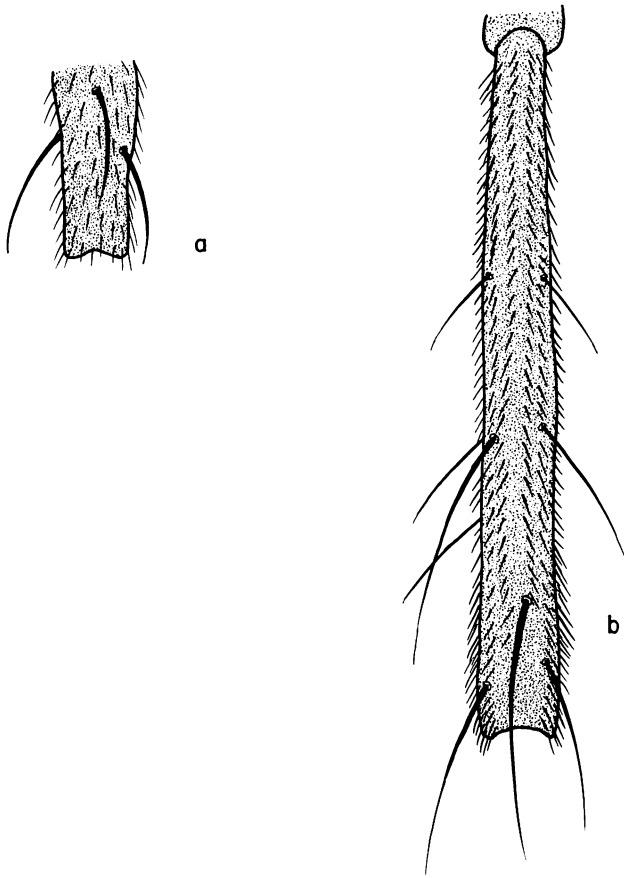


Figure 65—*Lispocephala kauaiensis* (Grimshaw): a, apex of hind femur, dorsal; b, hind tibia, dorsal.

the right, so this is obviously not a reliable character. In other respects this apparently fits the characteristics of *triangulifera* in all respects, although the male genitalia have not been studied. The legs are predominantly yellow with the hind femora blackened on apical two-fifths to one-half and the tarsi dark brown to black. Ocellar triangle extending almost to anteromedian margin of front. The third antennal segment is dark brown and the arista is broken on the type but is apparently haired on basal half with the hairs moderately short, the longest about one-half to two-thirds the width of third segment. The posterior bristle at the middle of mid tibia is rather weak, extending slightly less than half the distance to apex of segment and two rather short anteroventral bristles are present on hind tibia (fig. 65b). Abdomen mostly subshining brown, brown pollinose on dorsum with anterior and lateral margins of terga gray pollinose. Sides of first two terga and hind portion of third broadly yellow in ground color, extensively brown over dorsum with narrow apical margins

yellow. Terga 4 and 5 entirely black in ground color except for the narrow apical and lateral margins which are yellow. Genitalia mostly dark brown to black with the lobes yellow to rufous.

Length of body, 5.0 mm.

One female specimen on hand from Kainamanu, Kauai, 3,800 ft., July 1952 (D. E. Hardy) may possibly be *kauaiensis*, but the antennae are all yellow and it fits *flavobasalis* (Grimshaw).

***Lispocephala montgomeryi* Hardy, new species (figs. 66a,b)**

Fitting in the confluens subgroup and in a distinct species group with *brunneipennis* n. sp. and *obscura* n. sp. It runs close to *xanthopleura* n. sp., from Maui, in the key and differs by having apices of hind femora brown; front entirely brownish red, and eye margins distinctly converging anteriorly; a small brown spot present on upper portion of each pteropleuron and mesonotum brown only on posterior portion; lacking postero- and anterodorsal bristles on hind tibia basad of median pair; and only one preapical dorsal on hind femur. Also, genitalia are very distinctive as shown in figures 66a,b and 73a,b. The two fit into different species complexes and probably are not related.

MALE. An almost completely yellow species. **Head:** Front dark reddish brown, gray pollinose but with the pollen not obscuring the ground color over median portion of front so that only the ocellar triangle and the orbits show up as distinctly gray. Frontal triangle comparatively short, extending only slightly beyond lower superior fronto-orbital bristles. Antennae entirely yellow, arista short plumose on basal halves. Palpi yellow with short black setae over apical portion. **Thorax:** The brown marking confined to area between dorsocentral rows and predominantly behind suture, with the mark rather broad on

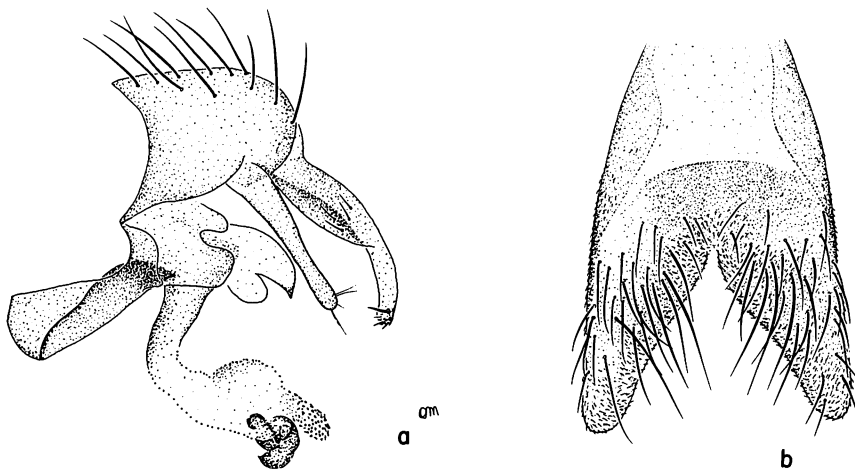


Figure 66—*Lispocephala montgomeryi* n. sp.: a, male genitalia, lateral; b, fifth sternum, ventral.

posterior portion filling area bounded by the first two pairs of dorsocentral bristles, narrowed in front extending to the suture as a vitta just slightly wider than acrostichal rows of setae. A slight discoloration of brown does occur on the anteromedian margin of the mesonotum in the area between the dorsocentral rows, and a faint indication of a brownish median vitta extends down middle toward the suture—it is not connected to the dark coloring of the posterior median portion of mesonotum. Anterior intraalars well developed. *Legs*: Almost all yellow except for brown apices of hind femora and brownish apical tarsomeres. One preapical dorsal bristle present on hind femur and hind tibia with two anteroventrals situated at and slightly beyond middle of segment. *Wings*: Lightly infuscated with brown, with the infuscation more intense over the apical third of the wing. Crossvein r-m situated slightly before middle of cell 1st M₂. Calypters pale yellowish-white. *Abdomen*: First three terga and base of fourth yellow with faint indication of brown vitta down middle of two and three. Fourth tergum with a subopaque black band across middle, yellow on anterior and narrow posterior margins. Fifth tergum yellow-brown to blackish, more distinctly yellow basally. Genital portion of abdomen yellow, tinged with brown. Fifth sternum shaped as in figure 66b, densely setose on posteromedian portion. Extension from cercus with two prominent preapical ventral setae and expanded on basal half below. Surstyli with prominent apical hairs as in figure 66a.

Length of body, 4.25 mm.

FEMALE. Unknown.

Named after Mr. S. L. Montgomery who has reared many of the *Lispocephala* in association with the native *Drosophilidae* and has made invaluable contributions to our knowledge of the biology and host relationships of our native flies.

Holotype male: Powerline Trail, Kauai, 2,400 ft., September 4, 1970, reared exrotting *Cyanea* bark (S. L. Montgomery).

Type in B. P. Bishop Museum.

***Lispocephala obscura* Hardy, new species (figs. 67a-c)**

Fitting the confluens subgroup which has preapical dorsal bristles on hind femur, antennae black, hind femora brown to black at apices, and one anteroventral bristle on hind tibia. It somewhat resembles *triangulifera* (Grimshaw) but differs by having the wings brown, dorsum of thorax almost entirely brown, ocellar triangle short, only one preapical dorsal bristle on hind femur, and abdomen lacking subshining, paired spots on terga. On the basis of the male genitalia it fits in a species complex with *brunneipennis* n. sp. and *montgomeryi* n. sp. It fits nearest the former but the mostly yellow legs and the characteristics of the fifth sternum and genitalia (figs. 67b,c) will differentiate it.

MALE. *Head*: Distinctly wider than high as seen from direct frontal view with face, genae and occiput white to silvery pubescent (pollinose), and frontal orbits, ocellar triangle, and vertex brownish yellow pollinose. Interfrontal area

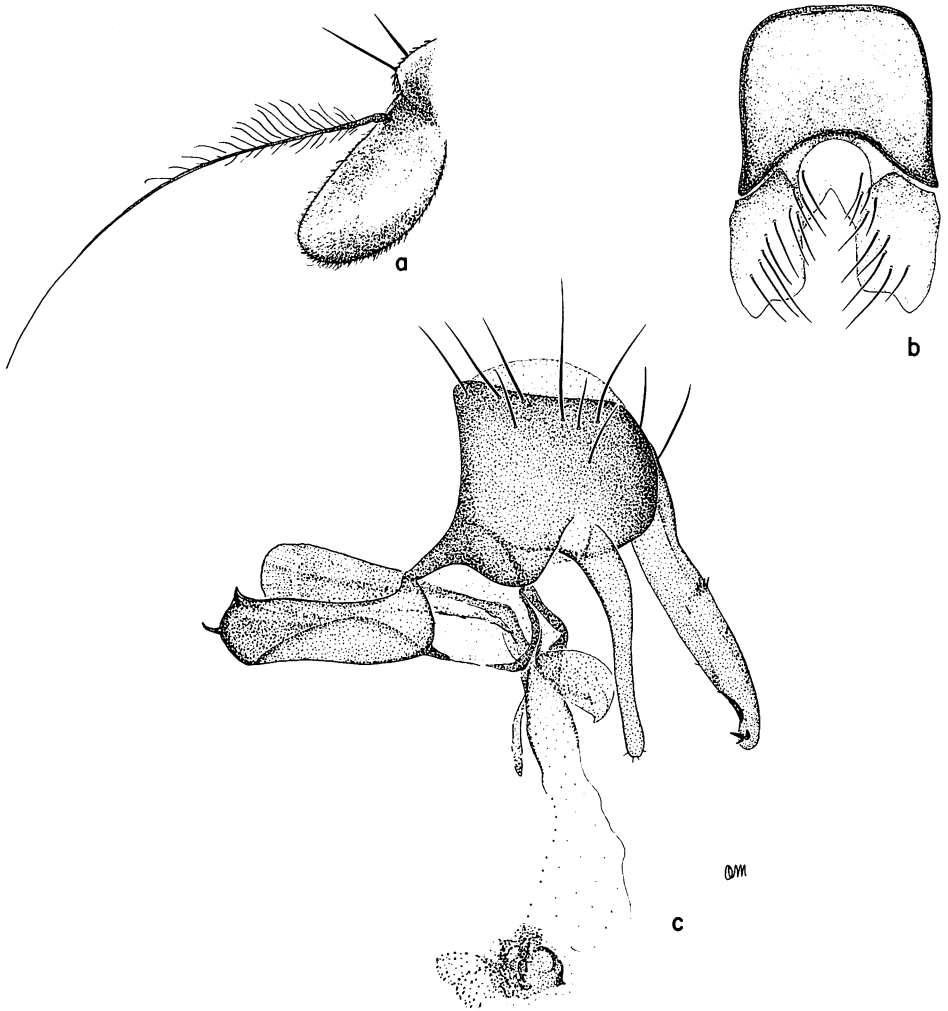


Figure 67—*Lispocephala obscura* n. sp.: a, antenna; b, fifth sternum of male; c, male genitalia, lateral.

dull brownish black, narrowly rufous in ground color on anterior margin. Ocellar triangle extending just slightly beyond lower superior frontal orbitals. Margins of front converging anteriorly so that it is distinctly narrower on lower margin, just above antennae, than on upper portion, at level of ocellar triangle. Antennae entirely dark brown to black with a tinge of yellow on upper apical portion of second segment. Aristae moderately plumose on basal two-fifths, the longest hairs about three-fourths the width of third segment (fig. 67a). Palpi slender, yellow, with two apical black setae and with numerous rather scattered black setae on outside median portion. *Thorax*: Pleura,

humeri, anterior corners of mesonotum, sides of suture, and metanotum, densely gray pollinose, contrasting from the dark brown pollinose mesonotum and scutellum. Two pairs of strong intraalar bristles present and with the first presutural pair of dorsocentrals rather small, about two times longer than acrostichal setae and about one-third to two-fifths the length of second presutural dorsocentrals. *Legs*: Mostly yellow with hind femora brown to blackish on apical third and with tarsi tinged with brown. Middle femora broadly brown at apices. Hind femur with one preapical dorsal and hind tibia typically with one anteroventral bristle. One paratype specimen on hand has a small secondary anteroventral on one side. *Wings*: Rather dark brown. I see nothing distinctive about the venation. The r-m crossvein is situated at middle of cell 1st M₂. Calypters yellowish, tinged faintly with brown on rims. *Abdomen*: Mostly subshining dark brown to black, rather lightly gray pollinose, with sides of first three terga broadly yellow and covered with gray-brown pollen, and with no indications of paired spots. Fifth sternum yellow, tinged with brown, shaped as in figure 67b. Extension from cercus bent slightly downward at apex, with two pairs of short, thick, preapical spines on venter and otherwise lacking setae ventrally. Also with a clump of short, stout setae on dorsomedian portion (fig. 67c). Surstyli long, slender, gently tapered, each with several inconspicuous setae at apex.

Length: body, 4.2 mm.; wings, 3.75 mm.

FEMALE. Unknown.

Holotype male: Honaunau Forest Reserve, Hawaii, January 31, 1967 (F. Yamasato and K. Y. Kaneshiro). Two male paratypes: one same data as type and one, Mt. House, So. Mauna Loa, Hawaii, December 18, 1967 (J. A. Tenorio).

Type in B. P. Bishop Museum. Paratypes in University of Hawaii collection.

***Lispocephala paloloae* Malloch (fig. 68a-c)**

Lispocephala paloloae Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):88.

Oahu (type-locality: Palolo). Molokai, Maui (?), and possibly Kauai.

Type male in B. P. Bishop Museum.

I have seen a series of specimens from a number of localities on Molokai and Maui and one female from Kauai, and am unable to differentiate these from the Oahu specimens. This may prove eventually to be a complex of species but at present no characters can be found to differentiate them.

Biology: No data are available. One specimen from Oahu was collected on *Touchardia* and one from Kauai was reared from rotting *Straussia* bark.

Rather small to medium-sized species fitting in the alakaiae group, confluens subgroup, near *triangulifera* (Grimshaw). It is characterized by having the legs entirely yellow except for brownish apical tarsomeres; the mentum yellow; thorax densely yellow-gray pollinose lacking brown markings; with the pleura, humeri, extreme lateral margins of mesonotum and scutellum, and

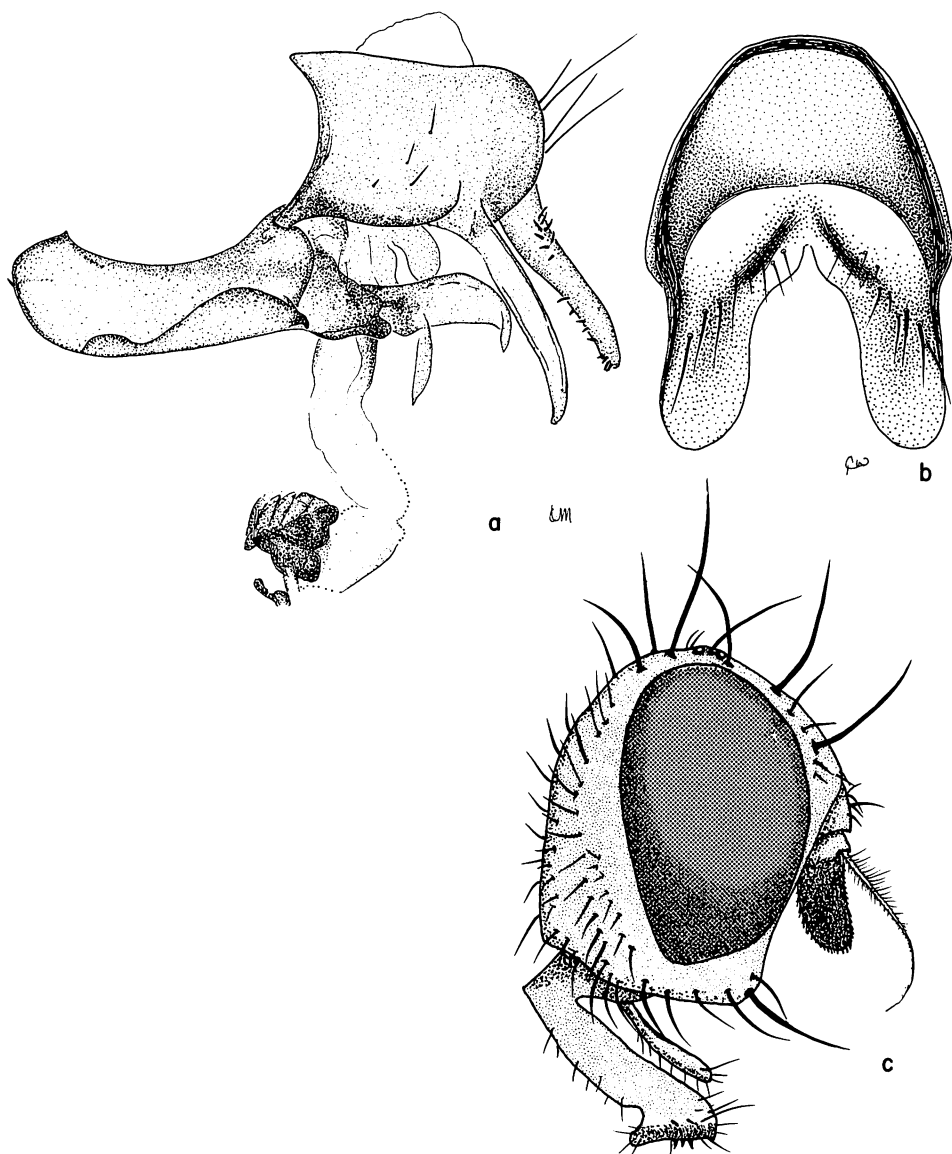


Figure 68—*Lispocephala paloloae* Malloch: a, male genitalia, lateral; b, fifth sternum of male; c, head, lateral.

ventral portion of scutellum mostly yellow, tinged with brown in ground color (visible when wet slightly with 70 percent alcohol). Some specimens may have the thorax gray pollinose, this is apparently variable. The female abdomen is predominantly yellow, colored brown to black down median portion. In the male, the first three and basal portion of fourth segments are broadly yellow on

sides, discolored with brown medianly and with terga 4-6 mostly brown to black in ground color, densely gray pollinose and with subshining, paired, brown to black spots on 3-5, these are indistinct on the latter. The head is densely yellowish pollinose with ocellar triangle extending to anterior margin and truncate apically, filling most of the interfrontal area. Third antennal segment mostly brown to black. Aristae moderately long plumose (fig. 68c), the longest hairs equal to about three-fourths the width of the third segment. Two anteroventral bristles are typically present on hind tibia but some specimens may have three. The fifth sternum of the male is short compared to its width, with the concavity on posterior margin extending almost half the length of the sclerite (fig. 68b), also the lobes extend well beyond the rows of setae. The genitalia are as in figure 68a, the extension from the cercus has numerous short thick spines along ventral portion.

Length of body: male, 4.5-5.25 mm.; female, 5.0-6.0 mm.

***Lispocephala parilis* Hardy, new species (fig. 69a,b)**

Fitting in the confluens subgroup of species by having preapical dorsals on hind femora and usually three anteroventral bristles on hind tibiae. Because of the predominantly dark-colored legs, it fits very near *fuscobrunnea* Malloch. Differing by having the palpi entirely yellow, not brown to black apically; third antennal segment yellow on inner basal portion rather than all black; frontal triangle and parafrontalia gray not brown; mesonotum predominantly gray not brown, and paired brown spots on the abdominal terga very indistinct, difficult to discern.

MALE. *Head:* Mostly gray pollinose except for the compound eyes and for the interfrontalia and anterior margin of front. Lower margin of front rufous, tinged with brown in ground color. Interfrontalia opaque black, rather lightly gray pollinose. Frontal triangle extending beyond upper inferior, fronto-orbital bristles. Antennae mostly brown to black, narrow apices of second and broad inner bases of third yellow. Aristae long pubescent to short plumose on basal halves. *Thorax:* Densely gray pollinose, with faint indications of brown vittae down dorsocentral lines. Anterior supraalars strong. Calypters white, tinged faintly with yellow. *Legs:* Femora reddish brown to blackish. Three rather strong preapical dorsal bristles usually present on hind femur and hind tibia typically with three anteroventral bristles; this is apparently variable, some specimens have only two each of the above bristles. *Wings:* Subhyaline, with faint tinge of brown over the membrane. I see nothing distinctive about the venation. *Abdomen:* Mostly dark brown to black in ground color, with sides of terga 1-3 broadly yellow, and with only faint indications of subshining brown to black spots on terga 3-5, as seen in end view. The genitalia are very similar to those of *fuscobrunnea* and other species of the general grouping, which have preapical dorsal bristles on the hind femora. The surstyli are sharp pointed, bent downward at apices. The extension from cercus has short, thick, preapical, ventral teeth, a few setae scattered along venter at middle, and a row of

short spinules on each side of dorsal basal portion (fig. 69a). The fifth sternum is shaped as in figure 69b.

Length: body, 6.0 mm.; wings, 5.5 mm.

FEMALE. Fitting description of male in most respects. Frontal triangle reaching almost to anterior margin of front. Abdomen mostly brown to blackish in ground color, yellow on sides only of first two terga; rather densely gray pollinose on sides, subshining brown to blackish over dorsum, and with bases of terga narrowly gray.

Length: body, 7.5 mm.; wings, 7.0 mm.

Holotype male and allotype female: Ukulele Pipeline, Haleakala, Maui 5,000 ft., July 12, 1919 (collector not given). Six paratypes, two males and four females: Upper Hana forest, Maui, 5,600 ft., July 8, 1973 (G. Merritt and C. H. Whittle); one labeled edge of forest and what appears to be Keanae Valley (the handwriting is not clearly legible), Haleakala, Maui, July 22, 1919, 5,800 ft. (no collector given); Kahikinui Forest Res., Maui, November 1973 (S. Montgomery); Kamoku flats, Molokai, March 18, 1966, in malaise trap (C. M. Yoshimoto); and Pepeokae, Molokai, 4,000 ft., July 30, 1939 (D. E. Hardy).

Type and allotype in B. P. Bishop Museum. Paratypes in collection of University of Hawaii and U.S. National Museum.

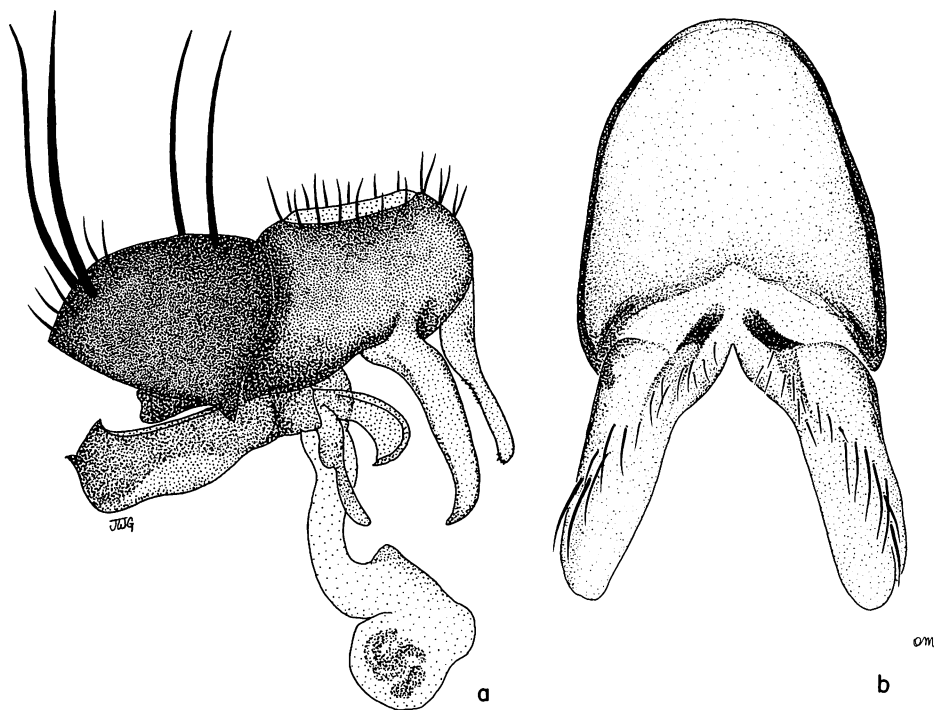


Figure 69—*Lispocephala parilis* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

***Lispocephala pauciseta* Hardy, new species (figs. 70a, b)**

Fitting in the confluens subgroup very near *flavobasalis* (Grimshaw) and possibly represents only a subspecies. The only differentiating character I find is that the lobes of the fifth sternum are by comparison sparsely bristled. In *pauciseta* only five or six black bristle-like hairs are present, followed by two or three setae (fig. 70b). The surstylus is rather distinctly narrowed basally and appears to be more slender than in *flavobasalis*. Also, the parameres appear to be different in shape as shown in figure 70a (cf. figs. 60a,b). The hind tibia of some specimens has two anteroventral bristles situated beyond the middle, in *flavobasalis* one anteroventral bristle is present on the hind tibia. The latter character is obviously variable in this entire subgroup of species and may not be reliable. In the type male, allotype female, and some of the paratypes, two anteroventrals are present and in other specimens only one is present. Otherwise fitting the description of *flavobasalis*.

Length of body, 4.5 mm.

Holotype male and allotype female: Pahole Gulch, Mokuleia, Oahu, 2,000 ft., January 9, 1974 (J. K. Obata and S. L. Montgomery). Fifty-one paratypes, 18 males and 33 females, mostly same data as type, have the following localities on Oahu: Peacock Flats, Oahu, February 23, 1970 (S. L. Montgom-

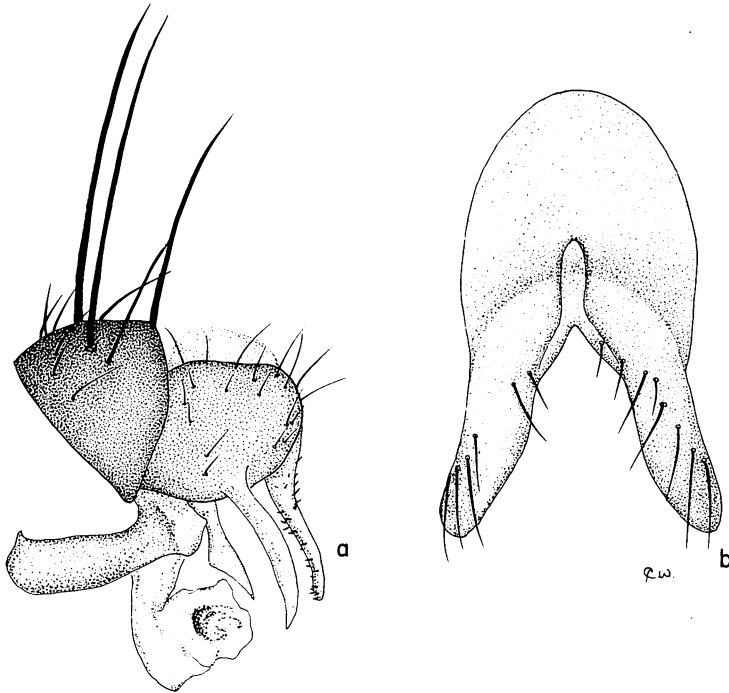


Figure 70—*Lispocephala pauciseta* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral.

ery); Honolulu Mts., Oahu, 1,500 ft. (no collector given); Peahinaiana Ridge, April 28, 1929 on *Broussaisia* (O. H. Swezey); Mount Olympus, July 21, 1935–August 16, 1936, 2,400 ft. (F. X. Williams); Hidden Valley, Kahana, May 31, 1970, reared ex rotting bark *Tetraplasandra* (S. L. Montgomery); Kalihi Valley, 1,000 ft., November 10, 1960 (L. W. Quate); and Mount Tantalus, July 1956 (D. E. Hardy).

Type, allotype, and a series of paratypes in B. P. Bishop Museum. Other paratypes in collections of U.S. National Museum and the University of Hawaii.

***Lispocephala rufibasis* Malloch (figs. 71a–c)**

Lispocephala rufibasis Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):84.

Molokai (type-locality: Kamoku). Hawaii? (One paratype, Kilauea—the paratype is very probably a different species.)

Type female in B. P. Bishop Museum. Paratype female in U.S. National Museum.

Fitting in the *alakaia* group of species in the *confluens* subgroup and, because of the black femora, mostly black antennae, yellow palpi, paired spots

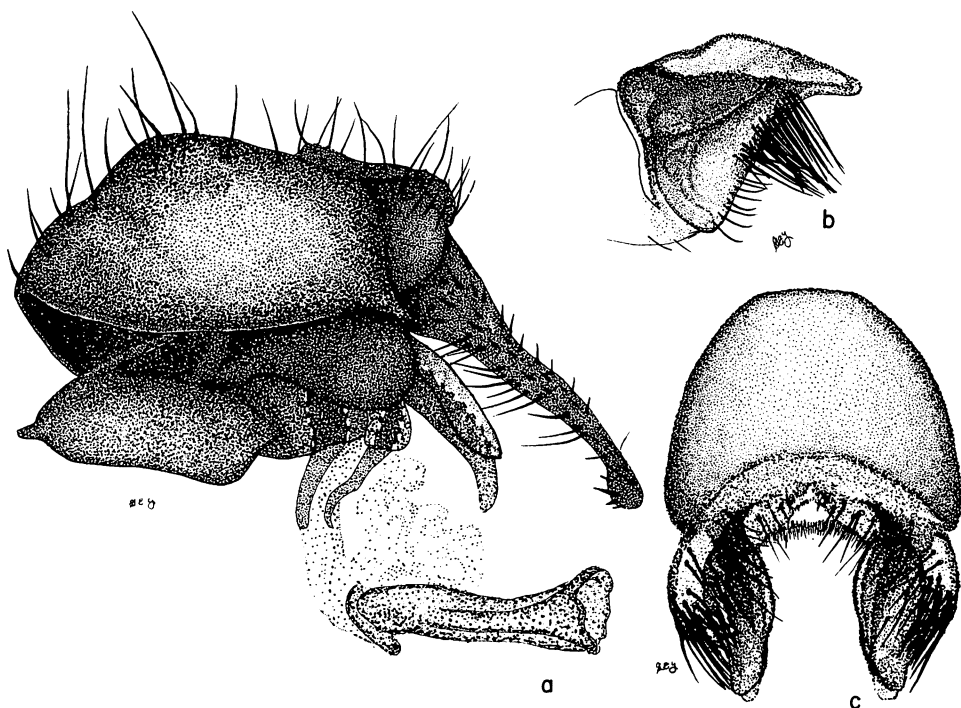


Figure 71—*Lispocephala rufibasis* Malloch: a, male genitalia, lateral; b, fifth sternum of male, lateral; c, fifth sternum, ventral.

on the abdomen, and the male genital characters, it is closely related to *implumis* n. sp., from Oahu. Both of these species have the surstyli well developed and the apical portion of the aedeagus trumpet shaped (fig. 71a). Also, the fifth sternum is developed into a prominent, bilobed, shelf-like platform dorsally (figs. 71b,c).

Length of body, 5.5–6.5 mm. (Malloch says “7.0 mm.”).

I have studied the type and have seen numerous specimens from the mountains of east Molokai. The species has previously been known only from the type female.

***Lispocephala subvittata* Malloch**

Lispocephala subvittata Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):88.

Hawaii (type-locality: Glenwood). This species is common over the island of Hawaii at elevations around 4,000–5,000 feet, a large series of specimens have been taken from many localities.

Fitting in the confluens subgroup very near *triangulifera* (Grimshaw) and apparently fitting that description in all details except that the anterior intraalar bristle is rudimentary, seta-like. The reliability of this character has not been ascertained and these may prove to be synonyms. The genitalia and other characters appear to agree in all respects. The hind tibia typically has two anteroventrals, but numerous specimens have been seen which have three. The middle femora are also typically brown to blackish at their apices whereas in specimens of *triangulifera* which have been studied to date the middle femora are entirely yellow, at least in the males. This is obviously a variable character since some specimens of *subvittata* have the middle legs all yellow except for the tarsi.

***Lispocephala triangulifera* (Grimshaw) (figs. 72a,b)**

Coenosia triangulifera Grimshaw, 1901, Fauna Hawaiiensis 3(1):36.

Hawaii (type-locality: Kilauea).

Fitting very close to *subvittata* Malloch in the confluens subgroup of species, which have two preapical dorsal bristles on hind femur and typically two anteroventral bristles on hind tibia, third antennal segment mostly black, hind femora broadly brown to black at apices, and mesonotum with brown vittae or median brown markings. I see no way to differentiate it from *subvittata* except that two intraalar bristles are present, both about equal in length to anterior humeral bristle. Whereas in *subvittata* apparently only one intraalar bristle is present, the anterior is lacking or rudimentary. I had previously synonymized these since we could find no differences in the genitalia or other characters, but until we have further biological data it is perhaps best that these be treated as distinct species. Some specimens on hand have three anteroventrals on hind tibia and would fit *confluens* Malloch except for genital characters (fig. 72a).

Grimshaw included both male and female in his original description but his female is not the same species as his type male. The female fits in the group

with the long posterior bristle on front tibia, close to *longipes* and to *dexioides*. The following description is based upon the type male.

Face, occiput, genae, eye orbits, and frontal triangle densely yellow-gray pollinose. Interfrontal area dark brown, tinged with red. Frontal triangle not quite reaching the anterior margin. Basal segments of antennae rufous, tinged with brown; third segment dark brown to black. Aristae rather long plumose, the longest hairs are about equal in length to the width of third antennal segment. Thorax black in ground color, densely covered with yellowish gray pollen, and with three brown vittae extending down median portion; these are more distinct down dorsocentral lines. Legs predominantly yellow with apical portion of hind femora brown to black and with the tarsi predominantly brown to black. Hind femur with two preapical dorsal bristles and hind tibia with two anteroventrals (fig. 72b). First two terga of abdomen almost entirely yellow with just a small brown spot in median portion of second. Third tergum broadly yellow on sides with the triangular-shaped brown area extending across most of apex of segment, with the point reaching almost to base and with extreme apex yellow, covered with gray pollen. Terga 4 and 5 are predominantly gray pollinose, each with an imperfectly triangular-shaped mark extending from near apical portion and covering most of segment as seen directly from above, with points extending almost to base of segment and with

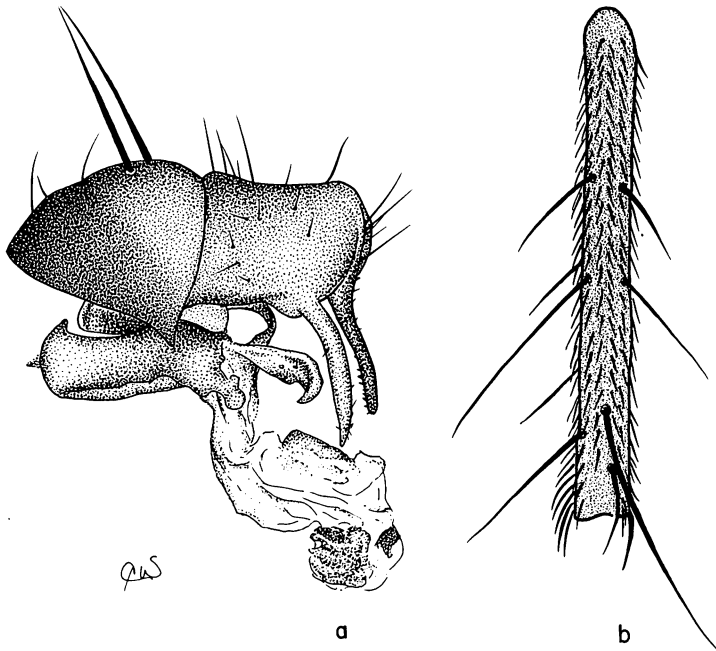


Figure 72—*Lispocephala triangulifera* (Grimshaw): a, male genitalia, lateral; b, hind tibia, dorsal.

extreme apices yellow in ground color, covered with gray pollen. Paired, subshining brown to blackish spots are present on terga 3-5. The genitalia are as in figure 72a.

Length of body, 5.0-5.5 mm.

***Lispocephala xanthopleura* Hardy, new species (figs. 73a,b)**

Belonging in the group of species with preapical dorsal bristles on hind femora and two anteroventrals on hind tibiae and, by the all yellow legs and the nature of the fifth sternum and male genitalia, fits in the paloloae complex of species. In the key, it runs near *montgomeryi* by having the pleura, scutellum, humeri, and sides of mesonotum yellow, also the abdomen predominantly yellow. It is readily differentiated by having the legs entirely yellow; median portion of mesonotum broadly black in ground color and with a strong pair of bristle-like cruciate prescutellars; genitalia distinctly different as in figures 66a,b and 73a,b; the pleura all yellow; lower portion of front yellow and sides of front parallel, not converging anteriorly. Also, the third antennal segment is predominantly black and the aristae much longer plumose. The two species apparently are not related.

MALE. Head: Front yellow to rufous except for ocellar triangle and eye orbits above lower superior fronto-orbital bristles, also vertex and occiput black in ground color. Face and genae yellow, covered with yellow pollen or pubescence. Ocellar triangle extending to a level about opposite lower superior fronto-orbitals. First two antennal segments and broad bases of third yellow, apical two-thirds of third black. Aristae moderately long plumose, the longest rays almost equal in length to the width of the third antennal segment. Palpi

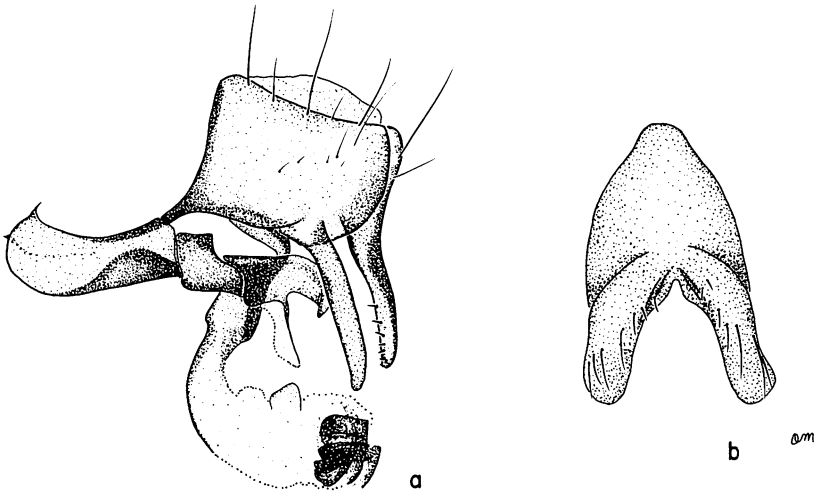


Figure 73—*Lispocephala xanthopleura* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

long and slender, almost straight-sided, scarcely enlarged apically. *Thorax*: Median portion of mesonotum broadly black in ground color through the area bounded by post-humeral and intraalar bristles and extending entire length of sclerite; this portion is evenly gray pollinose. Remainder of thorax including scutellum yellow covered with yellow pollen. Anterior intraalars well developed. *Legs*: Entirely yellow. Hind femur with two preapical dorsal bristles and hind tibia with two anteroventral bristles situated near apical three-fifths of segment. *Wings*: Subhyaline, faintly infuscated brownish yellow. I see nothing distinctive about the venation. Calypters white, tinged faintly with yellow. *Abdomen*: All yellow except for brownish red apical portion of fourth tergum and basal portion of fifth, also a black median vitta extends over terga 3 and 4. The genital portion of the abdomen is entirely yellow. Fifth sternum shaped as in figure 73b with only one row of setae or bristles extending diagonally across median portion of each lobe. Extension from cercus with numerous short, thick, ventral spinules, and surstyli rather blunt apically and lacking prominent setae (fig. 73a).

Length of body, 4.6 mm.

FEMALE. Unknown.

Holotype male: Haleakala, Maui, September 10, 1968, collected on silver-sword (J. A. Tenorio).

Type in B. P. Bishop Museum.

BREVISPINA GROUP OF SPECIES

A group of 23 presently known species are characterized by having short, thick, ventral spinules on at least the front and middle femora in one or both sexes. In some only the females have the ventral spinules and the surstyli are rudimentary in the males. The head is comparatively broad, distinctly wider than high in all except a few species in the atratipes subgroup in which the head is approximately as wide as high. All species in this group have no posterior median bristles on front tibiae; have one posterior on each middle tibia, and the hind tibia is without anteroventrals or possesses but one pair of anteroventral bristles.

BREVISPINA SUBGROUP OF SPECIES

With ventral spinules on femora of both sexes. Male surstyli well developed.

***Lispocephala badia* Hardy, new species**

Fitting in the brevispina group of species characterized by having short, thick ventral spinules on femora. Closely resembling *brunnidorsata* n. sp. by its size and all black body and legs; but differing by having a well-developed anteroventral bristle on hind tibia, rather than lacking this bristle, scutellum brown over dorsum, gray on sides, not gray above brown on sides, abdomen

with large paired black spots on terga, rather than lacking paired spots, with one preapical dorsal bristle on hind femur, rather than lacking preapical dorsals, and legs all black, rather than tibiae yellowish. Because of its resemblance to *brunnidorsata*, I am placing this in the *brevispina* subgroup, but its placement is not certain until males can be associated.

FEMALE. *Head:* Shaped as in other members of the *brevispina* group. Front opaque black over median portion, dark brown pollinose on orbits and ocellar triangle, the latter extends approximately to a level with upper inferior fronto-orbital bristles. The brown pollinosity of parafrontalia continues down the orbits of the face, extends as a narrow gray line on each side over lower portion of face along frontal suture, and is continuous with the large brown spot over each genae; the narrow margin along the eye is gray pollinose. Median portion of face silvery gray with a faint tinge of brown in the pollen over the area directly above the oral margin. Antennae entirely black, aristae short plumose. Palpi yellow, tinged rather faintly with brown at apices. *Thorax:* Black in ground color, brown pollinose over dorsum including scutellum and most of humeri, also brown on upper hind portion of each sternopleuron. The remainder of the pleura, narrow margins of humeri, metanotum, sides of scutellum, and sides of mesonotum behind notopleural bristles densely gray pollinose. Also a pair of submedian, narrow gray vittae extend down mesonotum from anterior margin to just beyond first pair of presutural dorsocentrals. Two pairs of intraalar bristles. Upper hind portion of each mesopleuron rather densely black setose. Calypters yellowish, tinged with brown. *Legs:* Entirely black, front basitarsus slightly less than half as long as tibia. Hind tibia with one strong anteroventral bristle at middle and hind femur with one preapical dorsal bristle in addition to preapical anterodorsal and posterodorsals. *Wings:* Slightly infuscated, especially on anterior margin. I see nothing distinctive about the venation. *Abdomen:* Entirely black in ground color, mostly brown pollinose over dorsum with narrow apices of terga gray and with large opaque black paired spots on terga 3-5.

Length of body, 6.75-7.0 mm.

MALE. Unknown.

Holotype female: Waikamoi, Maui, 4,000 ft., August 3, 1965 (J. K. Fujii). Nine female paratypes from the following localities on Maui: same as type, July-October 1958-1966 (D. E. Hardy and H. T. Spieth); Waikamoi Stream, 4,100 ft., July 1965 (C. M. Yoshimoto); Olinda, August 1932 (N. L. H. Krauss); and Kipahulu Valley, Camp 2, 1,250 m., August 13-20, 1967 (N. Wilson).

Two female specimens from Olaa Forest Reserve, Hawaii, 3,775 ft., September 3, 1965 (K. Y. Kaneshiro), appear to belong here but are not being designated as paratypes.

Type and some paratypes in B. P. Bishop Museum; other paratypes in collection of U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

Lispocephala brevispina Malloch (figs. 74a,b)

Lispocephala brevispina Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):81.

Endemic. Oahu (type-locality: Mt. Kaala). Type in B. P. Bishop Museum.

Belonging in the complex of species which have ventral spinules on the femora and the legs mostly yellow to rufous. Fitting near *haleakalae* n. sp., from Maui; it differs by having short, thick, ventral spinules on the front and middle tibiae, rather than the mid and hind; ocellar triangle rather elongate, extending almost to the lunule rather than to about opposite the upper inferior, fronto-orbital bristles; mesonotum distinctly brown vittate; only one intraalar bristle rather than two; and hind femur with a preapical dorsal bristle in addition to the preapical anterior dorsals and posterior dorsals.

FEMALE. First two antennal segments mostly rufous and base of third broad-

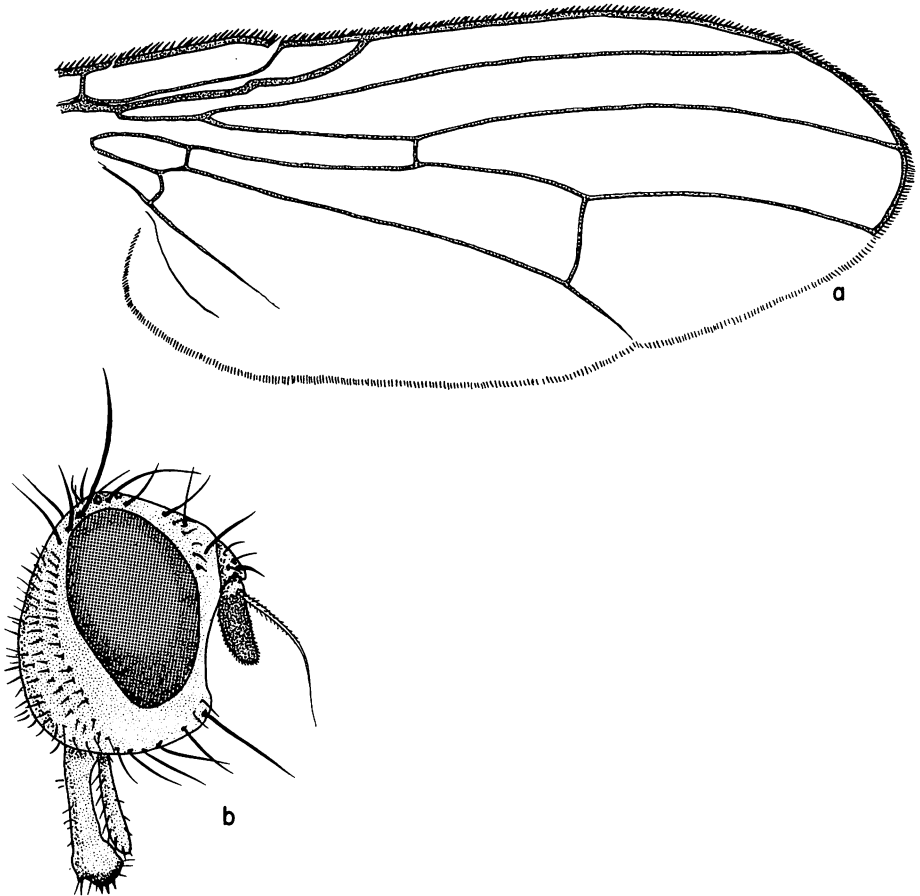


Figure 74—*Lispocephala brevispina* Malloch: a, wing; b, head.

ly rufous, to a level with arista, apical portion black. Aristae short plumose. Palpi entirely yellow. Head shaped as in figure 74b. Mesonotum gray with three narrow brown vittae. Calypters pale yellow, the upper about one-half as long as lower. Legs entirely yellow. The short thick ventral spinules are more numerous and conspicuous on front femora; on the middle legs they are more abundant on the basal half to two-thirds of the segment. One anteroventral bristle just beyond middle of hind tibia. The costal fringe (short spinules along costa) seems rather short, extending only slightly over one-third the distance between apices of veins $R_2 + 3$ and $R_4 + 5$ (fig. 74a). Abdomen mostly brown, tinged faintly with rufous and with sides of first two terga yellow. Terga 3 and 4 with large, subshining brown, paired spots and 5 with smaller, indistinctly paired spots.

Length of body, 5.75 mm.

MALE. Unknown.

Presently known only from the type female and from a headless paratype female "ex nest of *Hylocrabro tumidoventris*," S. E. Koolau Mts., Oahu.

***Lispocephala brunnidorsata* Hardy, new species (figs. 75a-c)**

Fitting the brevispina group because of the short, thickened ventral spinules on femora and belonging in the complex characterized by having the femora black and hind tibiae lacking anteroventral bristles. It runs near *kaalae* Williams but the two are not related; it differs by having the palpi yellow, rather than black, the calypters brownish yellow with rim of upper brown, rather than calypters white, and also the male fifth sternum and genitalia (figs. 75a-c) are distinctive from any other known *Lispocephala*.

MALE. *Head*: Shaped as in other species of this group. Front entirely opaque brown pollinose except for the rather narrow gray eye orbits. The ocellar triangle is scarcely differentiable but is slightly lighter brown pollinose than the interfrontalia, extending to about level with upper inferior fronto-orbital bristles. Antennae entirely black except for a tinge of red on inner basal portion of third segment and on inner apical portion of second. Aristae pubescent. Face gray pollinose with a faint tinge of yellow. Palpi entirely yellow, rather thickly black setose. *Thorax*: Mostly yellow-gray pollinose with mesonotum largely brown, gray on lateral margins and along suture, and with a pair of narrow gray submedian vittae from anterior margin almost to second pair of postsutural dorsocentrals, the vittae become indistinct beyond suture. One paratype male has the submedian vittae much more distinct, well developed to the second pair of postsutural dorsocentrals. Scutellum gray pollinose over disc, brown on sides. Two pairs of well-developed, intraalar bristles. Calypters brownish yellow with rim of upper distinctly brown. *Legs*: Coxae and femora black, except for extreme apices of front and middle femora. Tibiae and tarsi yellow except for black apical tarsomeres. Front and middle femora with short, thick, ventral spinules, especially on posteroventral surfaces. Posterior bristle of middle tibia extending about half the distance to apex of segment.

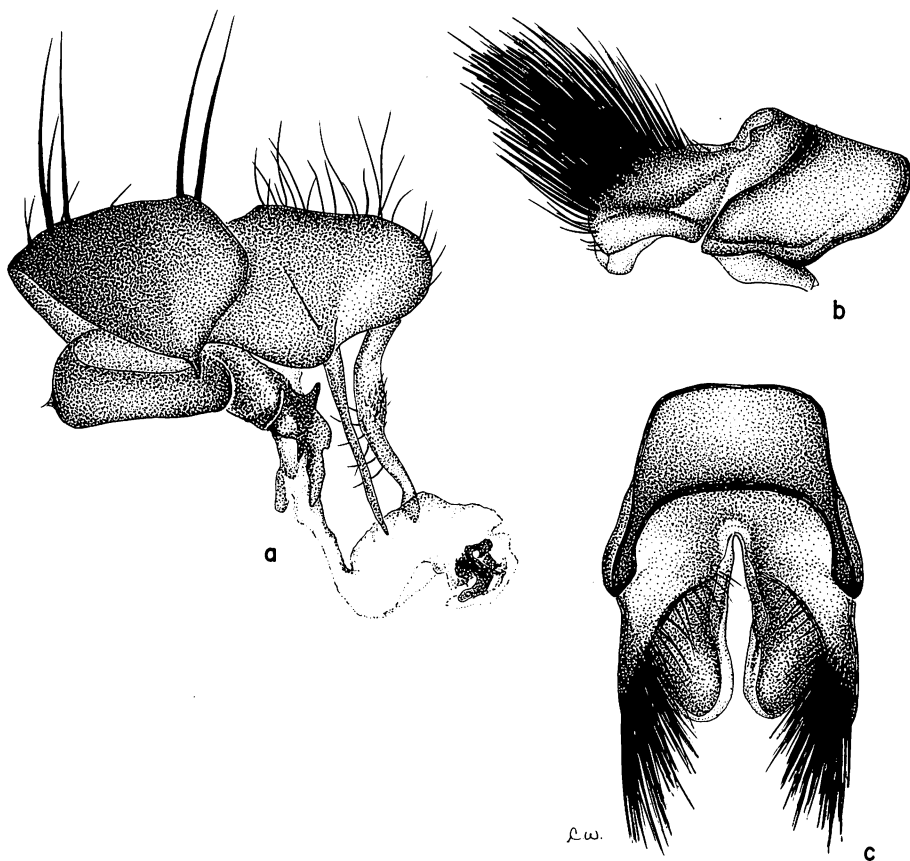


Figure 75—*Lispocephala brunnidorsata* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, lateral; c, fifth sternum, ventral.

Anteroventral bristles lacking on hind tibiae and with preapical posterodorsal and anterodorsal bristles on hind femur but no distinct preapical dorsal. *Wings*: Evenly brown fumose, crossvein r-m situated slightly beyond middle of cell 1st M_2 . *Abdomen*: Broadly yellow on sides of terga 1 + 2 and 3, narrowly yellow on posterior margins of 2 and 3; the yellow portion is densely yellow pollinose. Terga 4-6 gray on sides. All terga with a large, subshining brown mark covering the entire dorsal portion and with no indication of paired spots. Margins of fifth sternum very densely black haired (figs. 75b,c) and details of the genitalia as in figure 75a.

Length of body, 7.75 mm.

FEMALE. Fitting description of male except that the submedian gray vittae on anterior portion of mesonotum are very faint behind the second pair of presutural dorsocentrals and the abdomen is almost entirely subshining brown to black, gray at apices of terga.

Holotype male and allotype female: Ainahou Valley, northwest of Koolau Gap, Maui, ca. 5,000 ft., March 29, 1970 (D. E. Hardy). Forty-four paratypes, 33 males and 11 females, all from Haleakala, Maui: mostly same data as type, two Paliku, July 1963 and 1966 (D. E. Hardy), Ukulele Pipeline, Haleakala, 5,000 ft., July 13, 1919 (no collector given); a series from Upper Hana Forest, 6,000–7,000 ft., June 1973 (C. W. Whittle); one Holua, March 30, 1970 (D. E. Hardy); and one Hanawi Ridge Trail, Koolau Forest Res., 5,500 ft., August 1973 (S. L. Montgomery).

Type and allotype in B. P. Bishop Museum. Paratypes in the collections of the U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala caliginosa* Hardy, new species**

Fitting in the *brevispina* group of species with all black legs, near *badia* n. sp., but differentiated by having the calypters white, palpi black, and abdomen lacking paired black spots on the terga.

FEMALE. Appearing to fit all of the characteristics of *badia* except as noted above. Hind femur with preapical posterodorsal and anterodorsals but no dorsals. Abdomen entirely subopaque brown to blackish with narrow apices of terga gray.

Length of body, 5.3 mm.

MALE. Unknown.

Holotype female: Paliku, Haleakala Crater, Maui, July 25, 1962, in banana-bait trap (D. E. Hardy). One female paratype: Kipahulu Valley, Maui, Camp 3, 6,500 ft., August 27–29, 1967 (H. L. Carson).

Type in B. P. Bishop Museum.

***Lispocephala dispar* (Grimshaw) (figs. 76a–d)**

Coenosia dispar Grimshaw, 1901, Fauna Hawaiiensis 3(1):35.

Endemic. Molokai (type-locality: Molokai Mts.).

The syntypes, 1 male, 2 females, in British Museum (Natural History).

Fitting in the *brevispina* group of species and in the *brevispina* subgroup because of the presence of numerous short ventral spinules on the femora of both sexes, especially the mid and hind pairs; it fits in a complex which has one strong anteroventral bristle on hind tibia and the legs predominantly rufous. It is differentiated from *brevispina* and related species by having the mid and hind femora broadly brown to black at apices; the abdomen lacking paired spots on the terga and hind femur lacking a preapical dorsal bristle.

Front mostly dark brown, the frontal triangle is obscurely grayish and does not distinctly divide the brown front; the orbits are gray. Antennae entirely black, aristae short plumose to long pubescent (fig. 76a). Palpi yellow, rather thickly covered with short black bristles around apex and with more elongate hair-like bristles along ventral surface. Thorax entirely black, rather thickly gray pollinose, and no evidence of brown markings on dorsum. Two pairs of

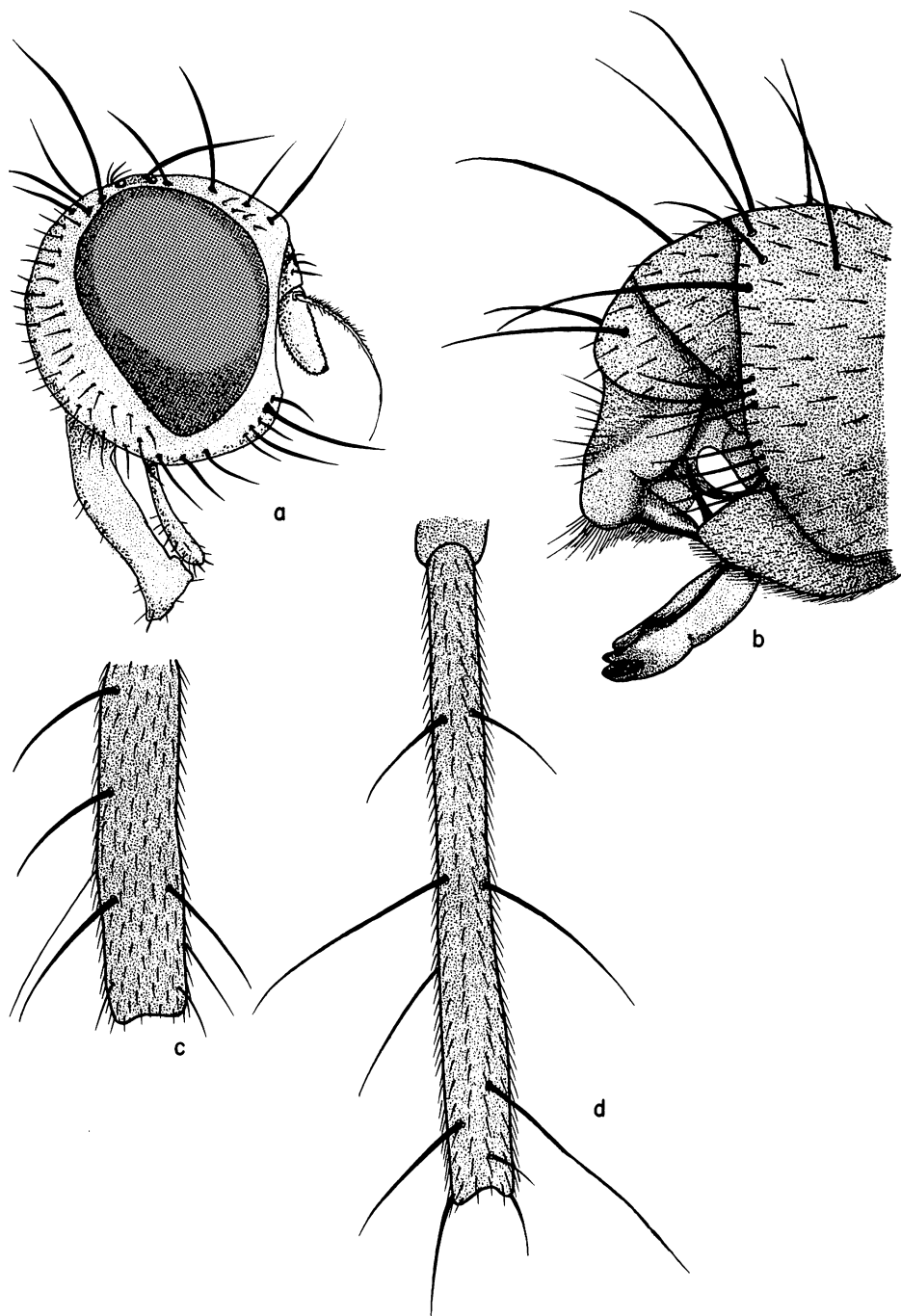


Figure 76—*Lispocephala dispar* (Grimshaw): a, head; b, apex of male abdomen, *in situ*, drawn from type; c, apex of hind femur, dorsal, from type; d, hind tibia, dorsal, from type.

well-developed intraalars. Calypters pale yellow-white, more distinctly yellow on rims. Wings faintly infuscated with brown. Crossvein r-m situated at apical $3/5$ of cell 1st M_2 . Middle and hind femora broadly brown to black on apices in both sexes and front femur of male mostly yellow with a faint discoloration of brown on dorsoapical surface; front femur of female dark brown to black over the dorsal surface on the apical two-thirds of the segment. Bristles of dorsal surface of hind tibia as in figure 76d and apex of hind femur as in figure 76c with no preapical dorsals. The short, black, ventral spinules are more abundant and conspicuous on middle femur, distributed over the ventral surface on the basal half of the segment, and with an anteroventral and a posteroventral row on apical half. Front and hind femora also with ventral spinules, especially on basal portion. Those of front legs are especially noticeable on anteroventral surface. The ventral spinules have not been checked on the type male. Grimshaw described the front legs as having numerous shorter bristles on the ventral surface. Adrian Pont (British Museum, Natural History) has checked the male specimen, the middle legs are missing and only one fore leg is present, there are no ventral spinules on fore femora. First two abdominal segments of male entirely yellow except for median, brown, longitudinal vittae, the remainder of abdomen dark brown to black in ground color rather densely gray pollinose. In the female the abdomen is almost entirely subshining black, narrowly gray at apices of terga; the male genitalia have not been relaxed for study, those of the type, seen in lateral view, are as in figure 76b.

Length of body, 6.5–7.5 mm.

***Lispocephala haleakalae* Hardy, new species (figs. 77a–c)**

Fitting in the *brevispina* group of species by having short, thick, ventral spinules on some of the femora. It appears to fit nearest to *brevispina* Malloch, from Oahu, because of the all yellow legs, one anteroventral bristle on hind tibia, and abdomen with paired, subshining black spots on terga 3–5. It differs from *brevispina* by lacking the thickened ventral spinules on the front femur; mesonotum not vittate, rather than with three vittae; ocellar triangle extending to about level with upper inferior fronto-orbitals, rather than extending to lunule; two intraalar bristles and no preapical dorsals on hind femur, rather than one intraalar bristle and one preapical dorsal bristle.

MALE. *Head:* About one-fifth wider than long as seen from frontal view. Front distinctly wider than long and entirely gray pollinose, tinged with rufous in ground color on lower portion just above lunule. Face yellow, gray pollinose. Scape and pedicel of antennae reddish brown, third segment mostly black, broadly rufous on inner basal surface. Aristae short plumose. Palpi yellow with rather numerous black setae at apices and along ventral margins. *Thorax:* Entirely black in ground color, densely gray pollinose. Calypters pale yellow-white, the upper extends over about one-half of the lower. *Legs:* Mid and hind coxae brown, tinged with rufous, and densely gray pollinose. Legs otherwise entirely yellow. Front tibia lacking a posterior bristle in median por-

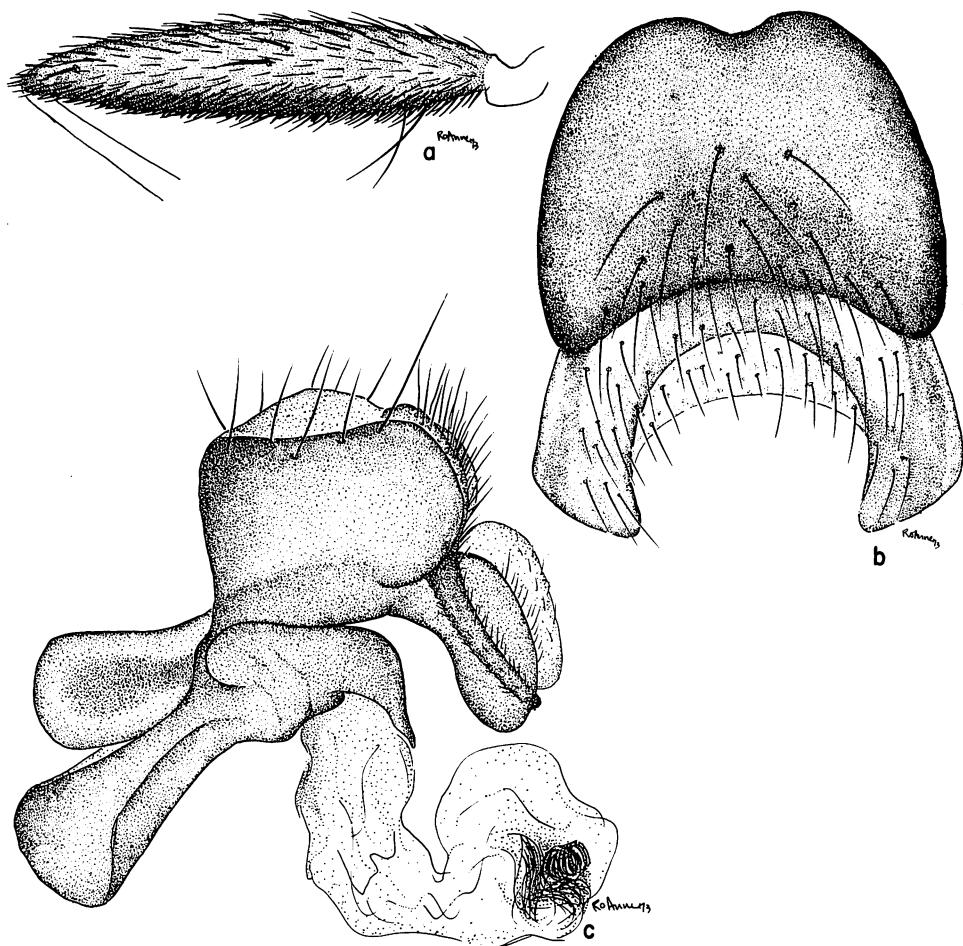


Figure 77—*Lispocephala haleakalae* n. sp.: a, middle femur, anterior view; b, fifth sternum of male; c, male genitalia, lateral.

tion and apical half with a dense mat of short, black setae on anteroventral surface, this is continuous with a dense covering of setae on the same surface of the basitarsus. Front basitarsus slightly less than one-half as long as tibia and first two tarsomeres equal to about two-thirds the length of tibia. Ventral surface of middle femur densely covered with short, thick spinules (fig. 77a), these are spread over entire ventral surface of basal half of segment and are confined to posteroventral surface on apical half, arranged in several irregular rows but diminishing to a single row of short bristles at extreme apex. Middle tibia densely covered with erect setae over ventral surface. Hind femur also with ventral spinules, not so densely placed or as thickened as on middle legs, and confined mostly to basal two-thirds of segments. Posterior bristles of middle tibia extending about three-fourths the distance to apex of segment. One

strong anteroventral bristle at apical two-thirds of hind tibia and with three pairs of anterodorsal and posterodorsal bristles plus one strong preapical dorsal bristle on hind tibia. *Wings*: Subhyaline, lightly infuscated. I see nothing distinctive about the venation. *Abdomen*: Black in ground color with a faint rufous tinge on sides of first tergum, densely gray pollinose, yellow-gray at apices of terga. As seen from end view with paired, subshining spots on terga 3-5. Fifth sternum of male with a broad U-shaped concavity on middle of hind margin extending nearly two-fifths the length of segment (fig. 77b). Apical projection of cercus with a subapical, ventral spine. Surstyli capitate, rather greatly enlarged apically, and parameres and aedeagus as in figure 77c.

Length of body, 5.2 mm.

FEMALE. Unknown.

Holotype male: Haleakala, Maui, 5,000 ft., no date or collector given.

Type in B. P. Bishop Museum.

***Lispocephala hualalaiae* Hardy, new species (figs. 78a,b)**

Fitting in the brevispina group of species, running near *haleakalae* n. sp., from Maui. The two are not closely related. The male fifth sternum and genitalia are completely different (figs. 77b,c and 78a,b): no anteroventrals are present on hind tibia; only one intraalar bristle present on mesonotum; aristae pubescent; and the femora are less densely spinulose and the middle tibiae lack erect ventral setae.

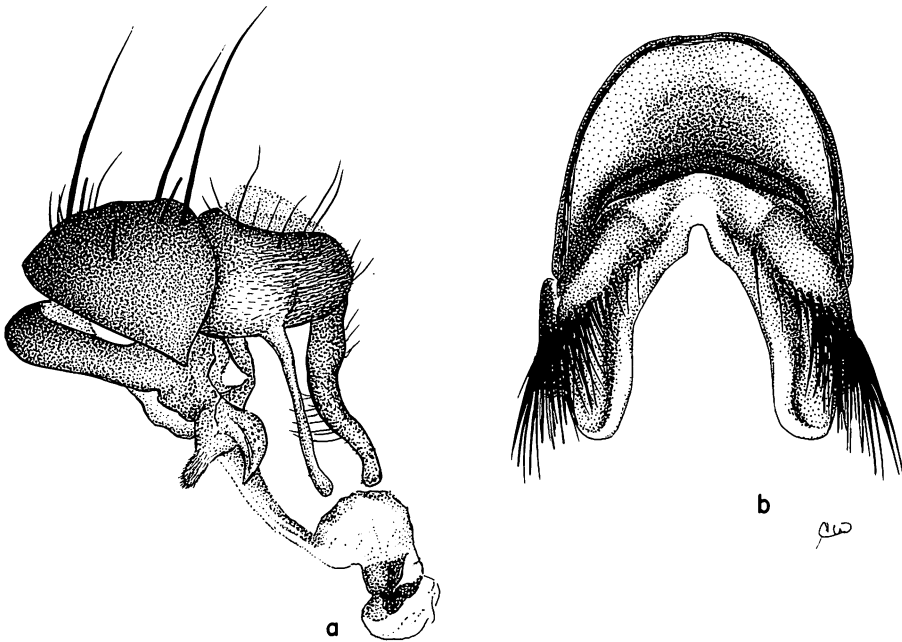


Figure 78—*Lispocephala hualalaiae* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

MALE. *Head*: Slightly wider than long. Interfrontal area opaque black; ocellar triangle and eye orbits gray pollinose, the former extending almost to upper inferior fronto-orbitals. Third antennal segment black, except for narrow, yellow inner basal margins. Aristae pubescent on basal portions. Palpi pale yellow. *Thorax*: Densely gray pollinose with faint indications of narrow brown vittae down dorsocentral rows. Two pairs of strong presutural dorsocentrals present. Calypters hyaline, rims yellowish white. *Wings*: Subhyaline, faintly infuscated. Crossvein r-m situated at middle of cell 1st M₂. *Legs*: Entirely yellow. All femora with short, thick, ventral spinules arranged on anteroventral and posteroventral surfaces and with two irregular rows on ventral surface on about basal half of each segment. Front basitarsus about three-fifths as long as tibia. *Abdomen*: First three terga yellow except for a broad brown vitta down median portion. Posterior portion of abdomen black in ground color, except for a narrow apical margin on fourth tergum, gray pollinose except for a subshining brown area over median portions of terga 4 and 5. Only faint indications of paired, black spots evident on terga 4 and 5, as seen in end view. Fifth sternum with a prominent, oblique, subapical, ridge bearing a dense brush of black bristles on each side (fig. 78b). Extension from cercus strongly curved in median portion and bearing long, black bristles in middle, on underside. Surstyli very slender, other details of the genitalia as in figure 78a.

Length of body, 5.0 mm.

FEMALE. Unknown.

Holotype male: Hualalai, Kona, Hawaii, April 4, 1972 (K. Y. Kaneshiro).

Type in B. P. Bishop Museum.

***Lispocephala longisetosa* Hardy, new species (figs. 79a,b)**

Fitting in the brevispina group because of the presence of numerous short, thick, ventral spinules on femora of both sexes and belonging in the complex of species characterized by the yellow legs and lack of anteroventral bristles on hind tibiae. It is differentiated from others in this complex by having only one intraalar bristle and having the mesonotum, scutellum, eye orbits, and abdomen mostly brown pollinose with short, gray vittae on anterior portion of mesonotum. Also, it is differentiated by having the fifth sternum of the male densely covered with long, black, bristle-like hairs (figs. 79a,b).

MALE. *Head*: Shaped as in other species of this complex with the interfrontal area dark brown to blackish, and the orbits and ocellar triangle yellow-brown pollinose. The triangle is elongate, extending to a point opposite half the distance between upper and lower inferior fronto-orbitals. Face entirely yellow, gray pubescent. Basal segments of antennae and base of third segment to a level with the arista yellow, apical two-thirds segment black. Palpi yellow with numerous short black setae. *Thorax*: Gray pollinose over pleura and metanotum, mostly brown over mesonotum, with humeri and extreme lateral margins of mesonotum gray; also with two short, submedian, gray vittae on anterior margin, these fade out before reaching suture. Two pairs of moder-

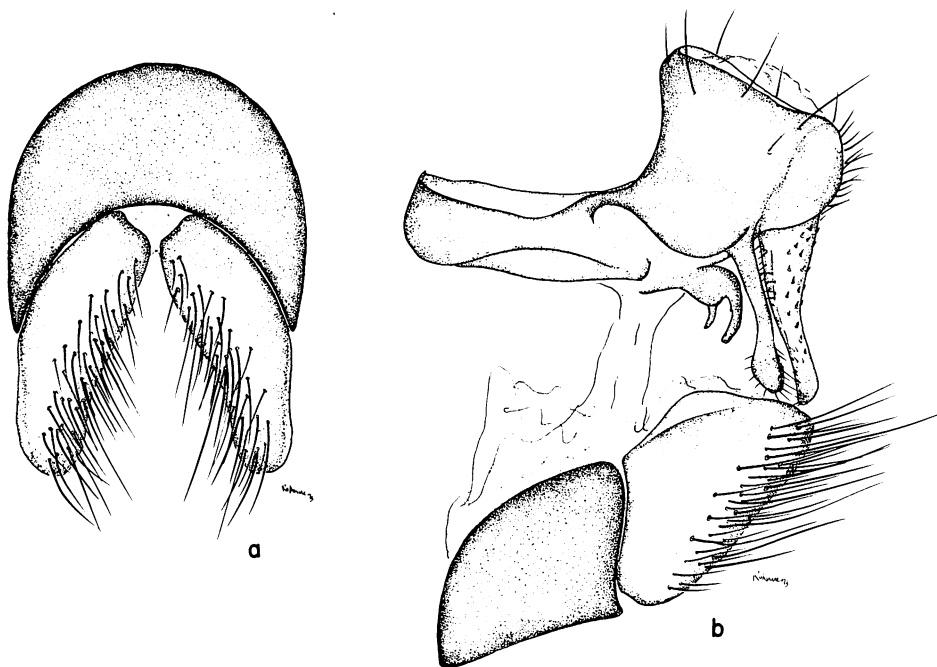


Figure 79—*Lispocephala longisetosa* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

ately strong, presutural dorsocentral bristles and only one pair of intraalars. Calypters pale yellowish with the rims distinctly yellow. *Legs*: Entirely yellow. Basal three-fifths of each femur with numerous short, thick, ventral spinules. Hind femur with one preapical, dorsal bristle in addition to the preapical anterodorsal and posterodorsals. *Wings*: Faintly infuscated; I see nothing distinctive about the venation. *Abdomen*: Mostly black, as seen from direct dorsal view, yellow on lateral margins of terga 1-4, and with no paired spots on the terga. As seen from dorsal view, mostly subshining, rather lightly gray pollinose, and each tergum with a narrow yellow-gray posterior margin. Fifth sternum densely black setose (fig. 79a), this is easily seen *in situ* (fig. 79b). The genital characters are as in same figure, the surstylus is clavate at apex.

Length: body, 6.0 mm.; wings, 5.7 mm.

FEMALE. Fitting description of male except for genital characters.

Length of body, 6.5-6.75 mm.

Holotype male: Waikamoi, Maui, 4,000 ft., July 11, 1965 (H. T. Spieth). Allotype female same locality as type, July 23, 1965 (D. E. Hardy). Twenty-two paratypes, 19 females and 3 males, some same data as type and allotype, others from following localities on Maui: Kipahulu Valley, Haleakala, 6,500 ft., August 27-29, 1967 (H. L. Carson); "Haelaau" (equals Kaulalewelewe), 3,000 ft., December 17, 1928 (E. H. Bryan); "Haleau" (probably a different spelling for Haelaau), West Maui Mts., November 7, 1932 (N. L. H.

Krauss); Waihoi Valley, 2,700 ft., July 13, 1972 (S. L. Montgomery); Puu Kukui ridge, 3,500–4,000 ft., September–July 1971–1973 (D. E. Hardy, K. Y. Kaneshiro); Paliku, Haleakala Crater, 6,200 ft., August 3, 1971 (M. D. Delfinado and D. E. Hardy); and Kahikinui Forest Res., September 1973 (S. L. Montgomery). Also Molokai: Wailau Pass, 3,000 ft., December 1937 (F. X. Williams) and east Molokai Mts., 2,400 ft., November 28, 1933 (F. X. Williams).

Type, allotype, and some paratypes in B. P. Bishop Museum. Other paratypes in the collections of the U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala mauiensis* Hardy, new species (figs. 80a, b)**

Fitting in the *brevispina* group by having short, thick, ventral spicules on femora, and in the complex of species characterized by lacking anteroventral bristles on hind tibiae, legs mostly yellow, and hind femur with preapical anterodorsal and posterodorsal bristles but lacking a preapical dorsal. It fits near *mimetica* n. sp. but differs by having the third antennal segment mostly black, the process developed from the cercus with a pair of strong, recurved spines at apex (fig. 80a), margin of fifth sternum of male densely black bristled (fig. 80b), as well as by other genital characters. The females run near *brunnidorsata* n. sp. but differ by having the mesonotum gray, lacking distinct

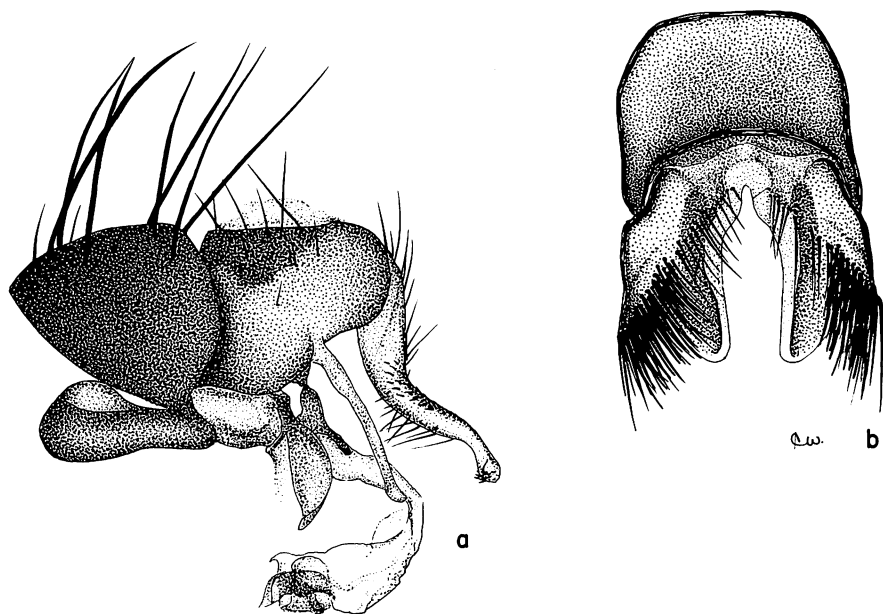


Figure 80—*Lispocephala mauiensis* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral.

brown vittae; the males are completely different as pointed out in the key. It is very close to *nana* n. sp., from Molokai, and the two are differentiated only by the male genitalia (cf. figs. 80a,b, 82a-c).

MALE. *Head:* Shaped as in other members of this group with the front as wide as long, measured from median ocellus to lunule. Interfrontal area dull reddish brown to black, lightly gray pollinose. Ocellar triangle and orbits gray pollinose with a faint tinge of yellow, the former extends distinctly beyond level with upper inferior fronto-orbitals. Face and genae gray with a tinge of yellow. Basal portion of third antennal segment rufous to a level with arista, apical portion dark brown to black. Palpi yellow. *Thorax:* Densely gray pollinose with no evidence of vittae. Two intraalar bristles present. Calypters white, tinged faintly with yellow. Legs yellow except for the brown mid and hind coxae and apical tarsomeres. Front and middle femora with two irregular rows of short, thick, posteroventral spinules extending over most of the length of the segment and with scattered black spinules over entire ventral surface on basal portion. *Wings:* Subhyaline. I see nothing distinctive about the venation. *Abdomen:* First three terga broadly yellow on sides, brown to black down median portions. Terga 4-6 mostly black in ground color, densely gray pollinose, with rather faint, paired, black spots on 4 and 5, as seen from end view in strong light; in the type and in some other specimens, the median portions of 3-6 are brown pollinose. The posterior margins of terga 2-4 are densely yellowish pollinose, obscuring the ground color. The fifth sternum is as in figures 80b and the genitalia as in figure 80a.

Length of body, 6.0 mm.

FEMALE. Fitting characters of male in most respects, sometimes with faint to rather distinct indications of vittae on mesonotum.

Length of body, 6.5-7.5 mm.

Holotype male and allotype female: Paliku, Haleakala Crater, Maui, 6,200 ft., July 11, 1966 (D. E. Hardy). Seventy-one paratypes, 20 males and 51 females, from the following localities on Maui: same as type, June 1952-October 1971 (D. E. Hardy, F. Kamiya, K. Y. Kaneshiro, G. K. Kobayashi, and J. A. Tenorio); Ainahou Valley, March 29, 1970 (D. E. Hardy); Holua, Haleakala Crater, March 30, 1970 (D. E. Hardy); Waikamoi, 4,000 ft., January-October 1926-1973, collected in association with native *Drosophila*, and some reared from rotting *Cheirodendron* leaves (E. Craddock, W. B. Heed, D. E. Hardy, K. Y. Kaneshiro, J. Prophet, H. T. Spieth, J. K. Fujii, and O. H. Swezey); near Puu Luau, 6,500 ft., April 28, 1945 (E. C. Zimmerman); Olinda, February-May 13, 1926 (O. H. Swezey); Kipahulu Valley, 1,250 m., August 13-17, 1967 (H. L. Carson and N. Wilson); Puu Kukui Ridge, 3,500-4,000 ft., July 1971 (D. E. Hardy); and Upper Hana Forest, 7,100 ft., October 1973 (C. W. Whittle).

Five female specimens are on hand which appear to belong here from Puu Kolekole, and Hanalilolilo, Molokai, July 1952 and 1964 and January 1973 (D. E. Hardy, C. Whittle); Olaa Forest Reserve, Hawaii, 3,775 ft., September 3, 1965 (K. Y. Kaneshiro); and Puu Hualalaei, Hawaii, 5,550 ft.,

June 13, 1966 (reared ex *Myrsine* leaves) (W. B. Heed). The latter are not being designated as paratypes.

Type, allotype, and a series of paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala mimetica* Hardy, new species (figs. 81a, b)**

Resembling *pollinosa* Malloch, from Maui, because of the predominantly yellowish, pollinose body, yellow legs, and antennae. The resemblance is superficial, the two are not related, and *mimetica* fits in the brevispina group because of the numerous, short, thick, ventral spinules on femora. It fits nearest to *mauiensis* n. sp. because of the yellow legs, lack of an anteroventral bristle on hind tibia, and preapical dorsal bristle on hind femur; also by having two intraalar bristles and the male surstyli elongate and slender (fig. 81a). It is readily differentiated by the all yellow antennae; by having the abdomen mostly gray pollinose, except for the subshining, paired, brown to black spots; the margins of the V-shaped cleft on fifth sternum of male sparsely black setose, compared to *mauiensis* (figs. 80b, 81b); the lobate extension of the cercus lacking a prominent, curved spine at apex, and aedeagus very different in shape from that of *mauiensis* (figs. 80a, 81b).

MALE. *Head*: Broader than high with front just slightly wider than long,

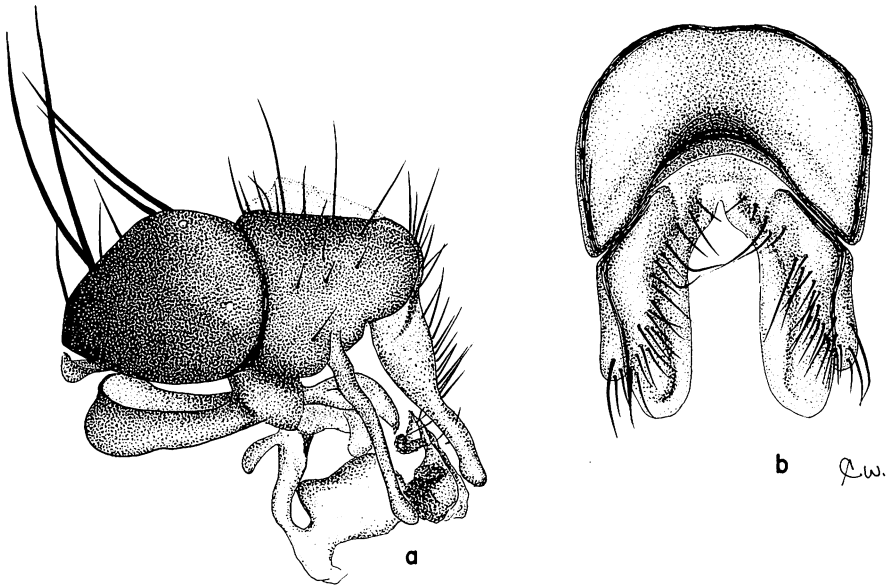


Figure 81—*Lispocephala mimetica* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

measured from median ocellus to lunule. Interfrontalia opaque black; orbits and ocellar triangle, the entire face, and remainder of head golden gray pollinose. The ocellar triangle extends to a point about opposite upper inferior fronto-orbital bristles. The upper inferior fronto-orbitals are slightly longer than are the superior fronto-orbitals. Antennae entirely yellow to rufous, the arista short plumose. Palpi entirely yellow with scattered black setae. *Thorax*: Yellow gray pollinose, no indication of vittae on mesonotum. Both pairs of intraalars strong, about equal in size to the first pair of presutural dorsocentrals. Calypters pale with the rims yellowish and the upper extending approximately three-fifths the distance over the lower. *Legs*: Entirely yellow except for a tinge of brown on tarsi and on mid and hind coxae. Front and middle femora with abundant, short, thick, ventral spinules, especially on apical two-thirds of segment. Front basitarsus slightly over half as long as tibia. *Wings*: Subhyaline. I see nothing distinctive about the venation. *Abdomen*: First three terga mostly yellow, brown down the median portion; apical terga of abdomen black, rather densely gray pollinose with paired, brown to black spots on 4 and 5. Fifth sternum and genitalia as in figures 81a,b as discussed above.

Length: body, 7.5 mm.; wings, 6.75 mm.

FEMALE. Fitting description of male in most regards. Abdomen mostly yellow pollinose, ground color of first four terga mostly yellow with black median marks over terga 3 and 4, but this is obscured by yellow-gray pollen over median portion, leaving a pair of subshining brown to black spots on each tergum. Fifth tergum entirely black in color, densely yellow gray pollinose.

Length of body, 7.5 mm.

Holotype male: Kamoku Flats, Molokai, March 18, 1966, in malaise trap (C. M. Yoshimoto). Allotype female: Puu Kukui Ridge, Maui, 4,000 ft., July 20, 1971 (D. E. Hardy). Two paratype females, same locality as allotype, one labeled "ridge above Haelaau," Maui (equals Kaulalewelewe or Puu Kukui Ridge), 3,000-3,600 ft., December 19, 1928 (E. H. Bryan), the other collected July 1973 (W. Ibara).

Type and allotype in B. P. Bishop Museum, paratypes in University of Hawaii collection.

***Lispocephala nana* Hardy, new species (figs. 82a-c)**

Fitting in the brevispina group of species in a complex closely related to *mauiensis* n. sp. I am unable to differentiate the females, the males apparently fit the description of *mauiensis* except for the genitalia. It can be separated, *in situ*, by the lobes of the fifth sternum being rather sparsely setose compared to *mauiensis* (figs. 80b and 82b,c). The lobes are margined with closely placed, fine setae not densely black bristled. As seen from ventral view, the dorsal or secondary lobes of the fifth sternum are much longer than in *mauiensis* (fig. 80a) and extend well beyond the setose margin (fig. 82a). The extension from the cercus of *nana* is not concave medianly on dorsal surface; dorsomedian

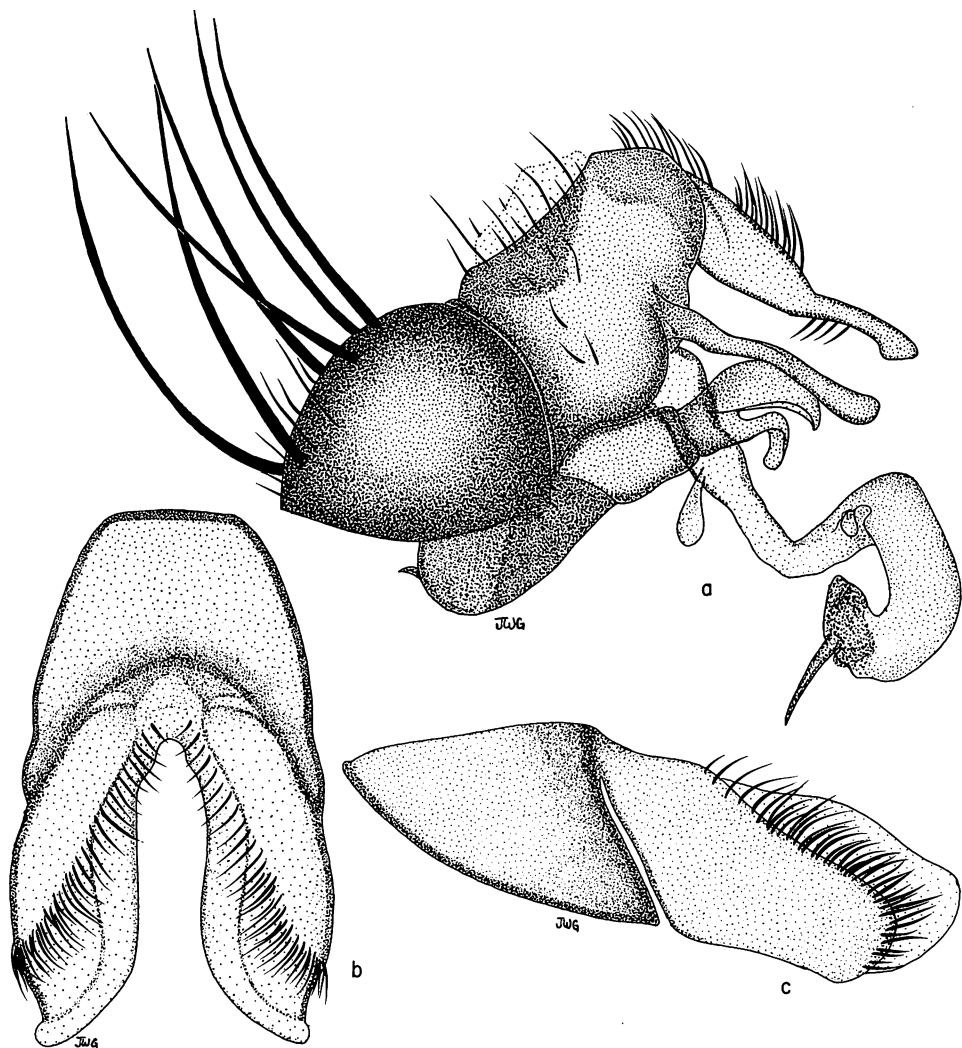


Figure 82—*Lispocephala nana* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral; c, fifth sternum, lateral.

spicules and a strong, subapical, hook-like spine on each side are lacking; only four pairs of ventral hairs are present and the dorsobasal hairs are much longer than in *mauiensis*. For other details of the fifth sternum and male genitalia compare figures 80a,b with 82a-c.

Length: male, 7.0 mm.; female, 7.5 mm.

Three female specimens on hand from Hawaii: Kilauea Forest, November 1973 (F. do Val); Olaa Forest Res., 3,775 ft., September 1965 (K. Y. Kaneshiro); and Puu Hualalei, 5,550 ft., June 1966, reared ex *Myrsine* leaves

(W. B. Heed), fit the description of *mauiensis* and probably belong to a third species of this complex.

Holotype male: W. Kawela, Molokai, 3,700 ft., January 31, 1974 (S. L. Montgomery). Allotype female: S. of Hanalilolilo, Molokai, 3,300 ft., January 19–21, 1973 (C. Whittle). Two female paratypes from Puu Kolekole, Molokai, 4,000 ft., July 1952 and 1964 (D. E. Hardy).

Type and allotype in B. P. Bishop Museum. Paratypes in the University of Hawaii collection.

***Lispocephala sigillata* Hardy, new species (fig. 83)**

Because of the abundant, short, thick, ventral spinules of femora, it fits in the brevispina grouping and in the complex of species, characterized by having the legs mostly yellow and lacking an anteroventral bristle on hind tibiae. It differs from all other species in this complex by having the femora broadly blackened at apices, the mesonotum chocolate brown over median portion, with a pair of submedian elongate gray marks before suture and another pair immediately behind suture (fig. 83).

FEMALE. Head: Shaped as in other species of the brevispina group. Interfrontalia dark-brown pollinose, eye orbits gray. Ocellar triangle brown, scarcely differentiated, and extending to a level approximately in line with upper inferior fronto-orbital bristles. Face entirely silvery-gray. Antennae black except for a tinge of rufous at inner basal portion of third segment. Aristae pubescent over basal portion. Palpi yellow, moderately black setose. Mouthparts entirely polished black. **Thorax:** Gray over pleura, metanotum, humeri, sides of mesonotum, and median portion of scutellum. Also with the submedian gray markings as noted above (fig. 83) and gray along sides of suture. Sides of scutellum: brown. Two prominent, intraalar bristles present. Calypters pale yellow-white, rim of upper pale brown, rim of lower pale yellow; the upper extends over about two-fifths of lower. **Legs:** All femora with numerous short, thick, ventral spinules; these are more abundant and scattered over entire ventral surface on the basal two-fifths–two-thirds of the segment and are extended along the posteroventral surface on the apical portion of the segment. Front basitarsus approximately half as long as tibia and with a dense brush of moderately long, black hairs or bristles on ventral surface near base. Hind femur with one preapical dorsal bristle in addition to the preapical anterodorsal and posterodorsals. **Wings:** Subhyaline. I see nothing distinctive about these. **Abdomen:** Mostly subshining, dark brown to black, with apices of terga gray. Extreme lateral margins of terga yellow-gray pollinose.

Length of body and wings, 6.0–6.75 mm.

MALE. Unknown.

Holotype female: “Kipuka #9,” Saddle Road, Hawaii, 5,200 ft., January 19, 1972 (D. E. Hardy). Three female paratypes all collected from “kipukas” (islands of vegetation surrounded by lava flows) on the Saddle Road. Two from Kipuka #14, 5,100 ft., February 26, 1972 (M. D. Delfinado), and one

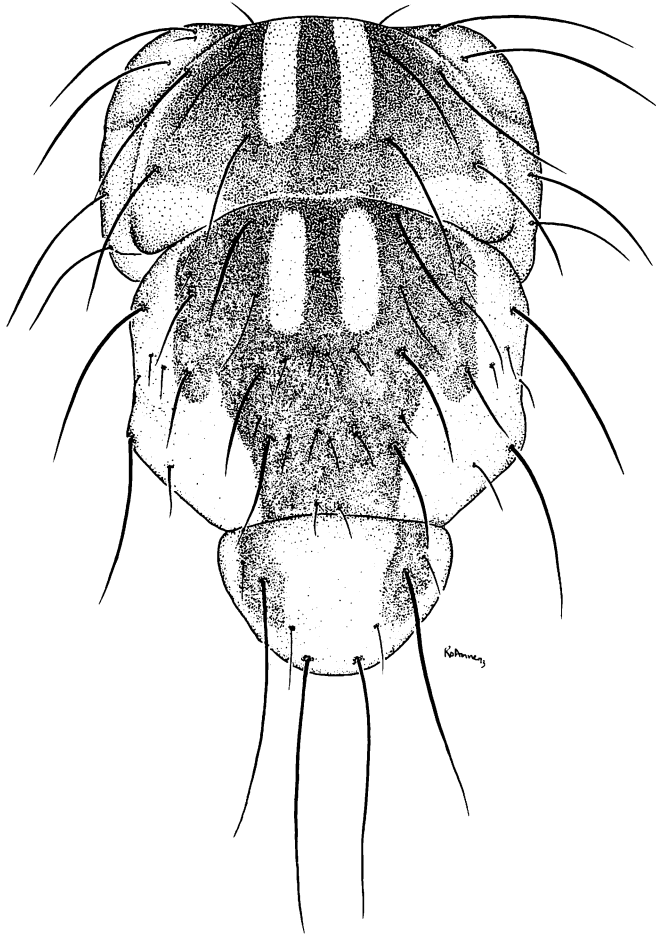


Figure 83—*Lispocephala sigillata* n. sp.: thorax, dorsal view.

Kipuka at 4,140 ft., December 10, 1971 (M. D. Delfinado). All were collected in association with native *Drosophilidae*. One female from Hanalilolilo, Molokai, 3,900 ft., January 24, 1973 (C. W. Whittle), seems to belong here but is not being designated as a paratype.

Type in B. P. Bishop Museum. Paratypes in University of Hawaii collection.

ATRATIPES SUBGROUP OF SPECIES

Ventral spinules present on femora of females, absent in males. Male surstyli rudimentary or absent. Hind femora usually with preapical dorsal bristles but in some species these are present in the females, lacking in males.

This subgroup is intermediate between the *alakaiae* and the *brevispina* groups of species.

The *argentifrons* complex of species have no anteroventral bristles on the hind tibia and no paired, black spots on the abdominal terga.

The *atratypes* complex has one anteroventral near middle of hind tibia and has large, conspicuous, paired, subopaque black spots on most of the terga (except in *ascita* n. sp.).

This group seems to be represented on all of the main islands, but the females cannot be differentiated and the males are not yet known for the populations (species?) from Oahu and Hawaii, also one from Maui.

It is probable that the immature stages of species in this complex are aquatic or semiaquatic. Most of the specimens have been collected on wet rocks or mosses along streams.

***Lispocephala argentifrons* Hardy, new species (figs. 84a,b)**

Belonging in the *atratypes* subgroup in a complex with *kaalae* Williams and *brunneifrons* n. sp., and the females apparently cannot be differentiated. The males are very characteristic and are readily separated by having the entire front, including the interfrontal area, silvery pollinose; the mesonotum predominantly silvery gray with the posteromedian portion, bounded by the post-sutural dorsocentrals, brown pollinose and with narrow, brown, presutural vitta extending along each dorsocentral row. Also, the sclerotized extension of the cercus is strongly capitate as seen in end view (fig. 84a), and a dense patch of short black bristles is present on each lobe of fifth sternum.

MALE. With rather scattered, short, black, rather inconspicuous spinules on femora, mostly on anteroventral and posteroventral surfaces, much less conspicuous than in female (keyed both as having and lacking ventral spinules), otherwise fitting the characteristics of other species of this complex. On the type specimen, a preapical dorsal bristle is present on hind femur just slightly posterior of the true dorsal surface, and I am unable to find a posterodorsal bristle. It is probable that these were broken off this specimen. Preapical dorsals and posterodorsals are present on other specimens examined. Fifth sternum with a dense clump of short black bristles on inner margin of each lobe, and male genitalia as in figure 84a with the surstyli very rudimentary, represented only by very short lobes (fig. 84b).

Length of body, 4.0 mm.

FEMALE. Fitting description of *kaalae*.

Holotype male: Paliku, Haleakala Crater, Maui, 6,300 ft., July 24, 1963 (D. E. Hardy). Allotype female: Kula pipeline, Maui, 4,200 ft., July 1956 (R. Namba). Seven paratypes, two males and five females, from the following localities on Maui: same locality as allotype, 4,500–5,000 ft., March 15, 1932 (O. Bryant); Waikamoi, 4,000 ft., March–August 1958–1968 (D. E. Hardy, L. W. Quate, and J. A. Tenorio); Makawao Forest Reserve, 1,280 m.,

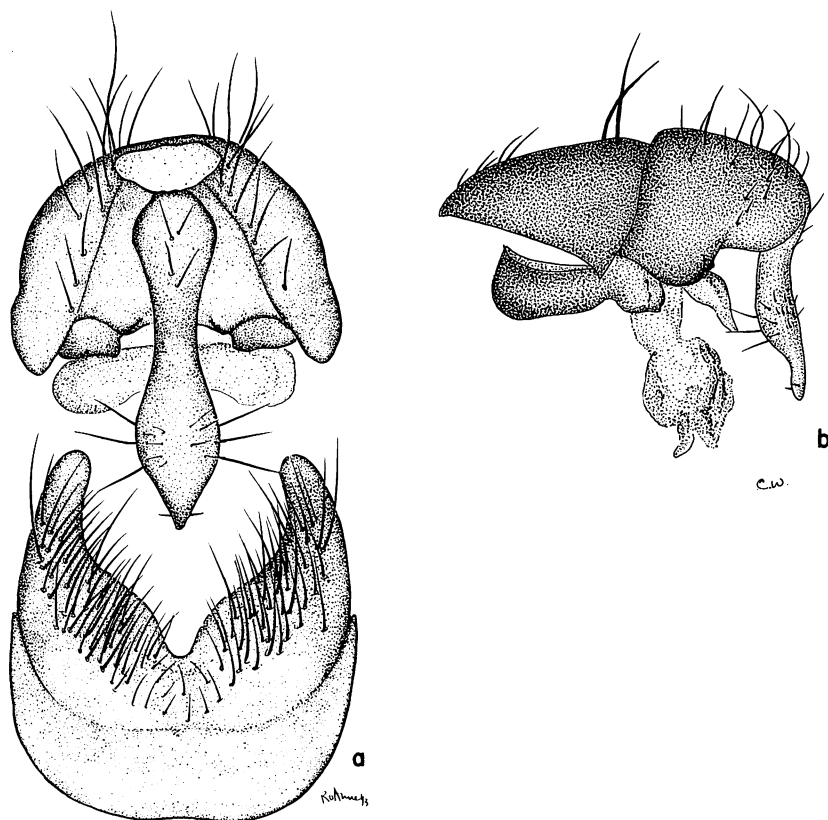


Figure 84—*Lispocephala argentifrons* n. sp.: a, male genitalia, including fifth sternum, ventral; b, male genitalia, lateral.

January 12, 1973 (J. R. Vockeroth). Also one specimen from Puu Kolekole, Molokai, July 30, 1959 (D. E. Hardy).

Type, allotype, and one paratype in B. P. Bishop Museum. Other paratypes in collections of U.S. National Museum, Canada, Department of Agriculture, and the University of Hawaii.

***Lispocephala ascita* Hardy, new species (figs. 85a-c)**

Fitting in the brevispina group of species in the atratipes subgroup and the atratipes complex. It resembles *ocellata* n. sp. and *comparata* n. sp.; but differs by having mid tibia with two posterior and one anterior bristle in median portion, two anteroventrals on hind tibia, and abdomen gray-brown pollinose, with no distinct paired spots. Also, the development of the fifth sternum (fig. 85b) and male genitalia are distinctive; the small, triangular surstyli are similar to those of *comata* n. sp. By the presence of the anterior bristle on mid-

dle tibia it would resemble *chaetoloma* n. sp., but that species has legs mostly yellow, only one posterior bristle on mid tibia, has preapical dorsals on hind femora, and the fifth sternum (fig. 88a) and genitalia (fig. 88b) are different.

MALE. Head: Distinctly wider than high. Front equally as wide as long with interfrontalia opaque black and ocellar triangle and orbits gray-brown pollinose. Ocellar triangle extending to a level about half way between upper and lower inferior fronto-orbitals. Antennae entirely black, aristae pubescent. Palpi dark brown to blackish except for a tinge of yellow over basal portions. **Thorax:** Gray-brown pollinose over mesonotum and scutellum, also brownish over median portion of each humerus and upper hind portion of each mesopleuron. Two strong, intraalar bristles. Calypters entirely white, the rims very faintly tinged with yellow. **Legs:** Black, bristling as noted above, lacking posteriors on front tibia, having two posteriors and one anterior near median portion of mid tibia (fig. 85c), and hind with two anteroventral bristles at middle. Hind femur lacking preapical dorsal bristles. Front basitarsus about one-half as long as tibia. **Wings:** Subhyaline, lightly infuscated. I see nothing distinctive about the venation. **Abdomen:** Entirely black, covered with gray-

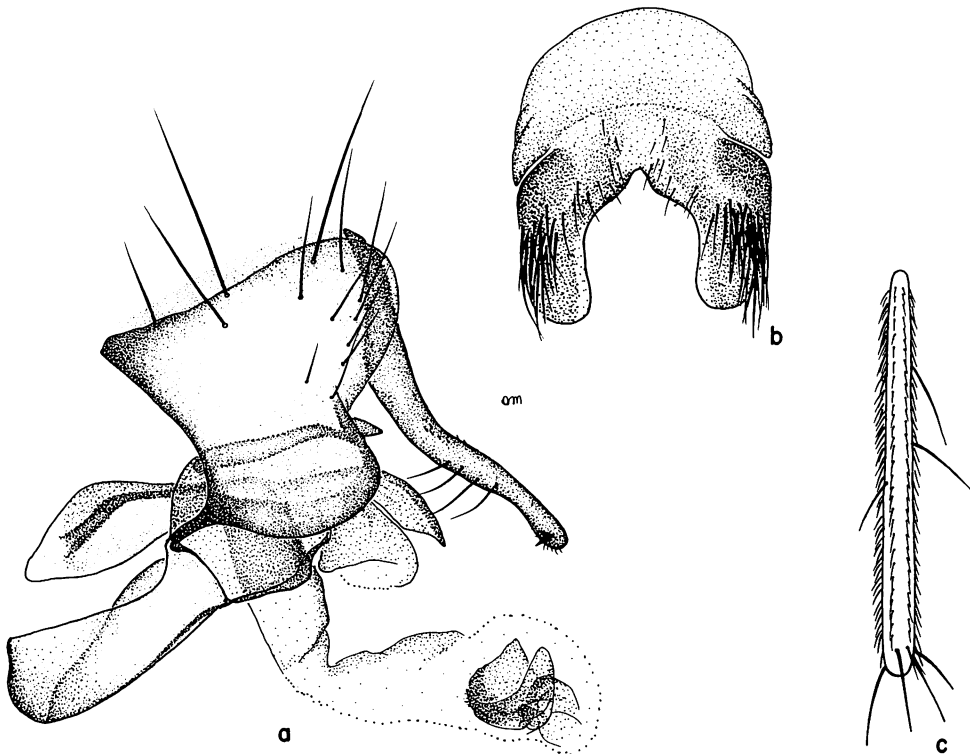


Figure 85—*Lispocephala ascita* n. sp.: a, male genitalia, lateral; b, fifth sternum of male; c, middle tibia, dorsal.

brown pollen and more distinctly gray at extreme apices of terga. Fifth sternum with prominent bristles or strong hairs across median portion (fig. 85b). Surstyli rudimentary, represented by a small triangular lobe on each side of epandrium (fig. 85a).

Length of body, 4.4 mm.

FEMALE. Unknown.

Holotype male: Halemanu Trail, 8,000 ft., Haleakala Crater, Maui, July 24, 1965 (C. W. Yoshimoto). One male paratype, Holua, Haleakala Crater, Maui, June 1953 (D. E. Hardy).

It should be noted that this species appears to be borderline between the groups which have and groups which lack a posterior bristle in middle of front tibia. It closely resembles *xenia* Malloch, from Hawaii, but differs by lacking the posterior median bristle on front tibia, the palpi black, rather than yellow; aristae pubescent rather than long plumose; legs almost all black, rather than front coxae and tibiae yellowish; and calypters entirely white, rather than with rims brownish.

***Lispocephala atratipes* Malloch (figs. 86a,b)**

Lispocephala atratipes Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):83.

Endemic. Hawaii (type-locality: Kilauea). Type male in B. P. Bishop Museum. *Coenosia* sp. (#14) Grimshaw, 1901, Fauna Haw. 3(1):41. One female, "in bad condition, from Kilauea," was probably this species.

Fitting in the brevispina group of species and the atratipes subgroup. It fits near *ocellata* n. sp., from Maui and Molokai, by having the calypters white, only one anteroventral bristle on hind tibia, abdomen with large, black, paired spots on terga, and fifth sternum with a prominent rounded lobe on each inner apical margin (figs. 86a,b). It is differentiated from *ocellata* by having the mesonotum brown with faint indications of gray vittae; scutellum brown on disc, gray on margins; preapical dorsal bristle present on hind femora and fifth sternum more sparsely setose on margins, having only one row of bristles and setae on each side over most of the length of the segment (fig. 86a). It shows close relationship to *eximia* n. sp. because of the male genitalia but differs by having legs and palpi black, not yellow and by other characters as discussed under *eximia*.

Head of male about as wide as high and that of female distinctly wider than high. The genae are comparatively broad, measured from lower eye margin to vibrissae, the space is distinctly wider than the third antennal segment. Antennae black, aristae pubescent. Palpi dark brown to black. Interfrontalia opaque black, ocellar triangle gray-brown pollinose, extending slightly beyond level with lower superior fronto-orbital bristles. Frontal orbits gray, tinged with brown pollen. Hind femur with one dorsal bristle in addition to the preapical posterodorsals and anterodorsals. The prominent subopaque, black, paired spots are present on terga 2-5 in both sexes. Sides of first three terga yellow in male, abdomen entirely black in ground color in female. Fifth sternum of male

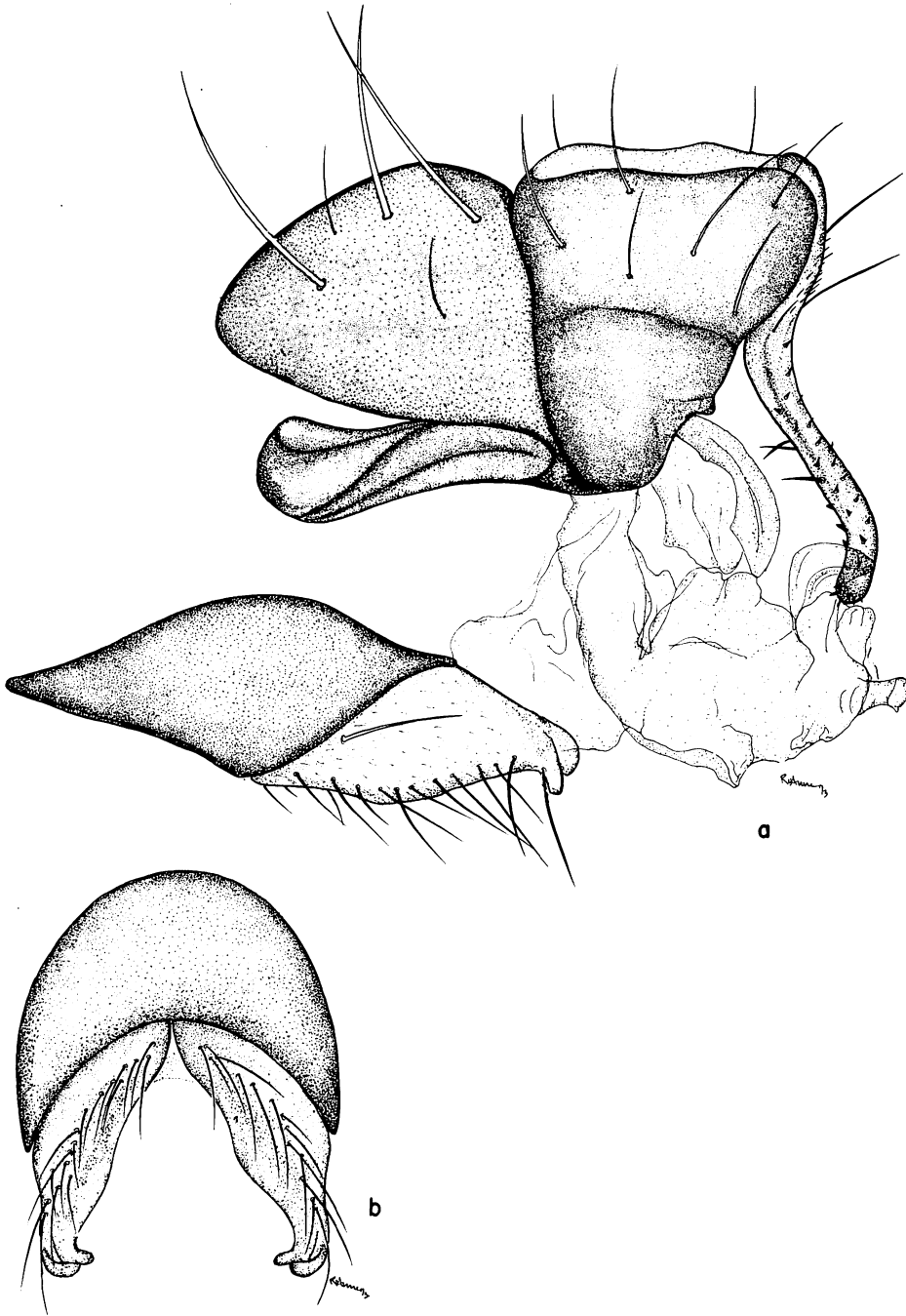


Figure 86—*Lispocephala atratipes* Malloch: a, male genitalia, lateral, showing fifth sternum; b, fifth sternum of male.

with a prominent lobe on each side at apex (fig. 86b). Surstyli lacking and aedeagus tube-like at apex. Other details of the genitalia as in figure 86a. For other characteristics, refer to the original description by Malloch.

Length of body, 5.0–5.5 mm.

I see no characters for differentiating the females of *atratiipes* and *ocellata*. The coloration of the mesonotum and scutellum does not seem to be reliable for this sex. Typically the coloration is as in the male but considerable variation has been seen.

This species is most abundant in the Kilauea area, elevation 4,000–5,000 ft.

***Lispocephala brunneifrons* Hardy, new species (figs. 87a,b)**

Fitting in the *atratiipes* subgroup and the *argentifrons* complex close to *argentifrons*, from Maui and Molokai, and apparently differentiated only by the males. The male differs from *argentifrons* by having the vertex, ocellar triangle, and parafrontalia dark brown, except for a narrow line of gray along orbits,

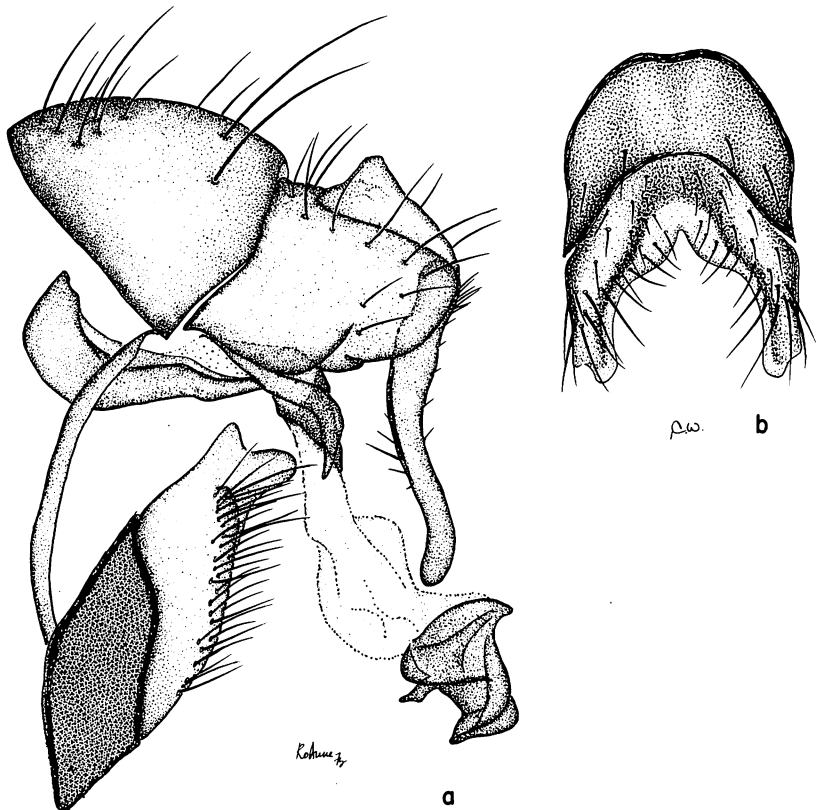


Figure 87—*Lispocephala brunneifrons* n. sp.: a, male genitalia with fifth sternum attached, lateral; b, fifth sternum, ventral.

and interfrontal area opaque black. Mesonotum entirely brown pollinose, except for gray margins; fifth sternum with scattered hairs but no stout bristles (fig. 87b), and the extension of the cercus not enlarged and very different in development, bent downward at the apex. The aedeagus is membranous through the median portion, enlarged, heavily sclerotized apically (fig. 87a). The ventral setae on the femora of the male are not thickened or spinulose, the vestiture is as typical for most *Lispocephala*. The hind femur has a distinct preapical dorsal bristle in addition to the preapical anterodorsals and posterodorsals. I see no other features which characterize this species, otherwise it fits the description of other members of the *argentifrons* complex.

Length of body, 4 mm.

FEMALE. Fitting description of *kaalae*.

The immature stages are probably aquatic.

Holotype male: Alakai, Kokee, Kauai, 4,000 ft., collected in malaise trap September 14, 1965 (C. M. Yoshimoto). Allotype female: 4 miles from Mohihi Stream, Kokee, Kauai, April 3, 1970, collected on wet rocks (M. D. Delfinado).

Type and allotype in B. P. Bishop Museum.

***Lispocephala chaetoloma* Hardy, new species (figs. 88a,b)**

Fitting the *atratypes* complex of species by having the male surstyli poorly developed, having one anteroventral bristle on hind tibia, preapical dorsal bristles on the hind femora and the head comparatively broad. It resembles *eximia* n. sp., from Hawaii, but differs by having the hind margin of fifth sternum densely bristled (fig. 88a), by the short but distinct surstyli (fig. 88b), as well as by other details. It would also differ from species of the *atratypes* complex by having a strong anteroventral bristle near apical 2/3 of mid tibia in addition to the median posterior bristle. In the key it would fit near *triangulifera* (Grimshaw) but belongs in an entirely different species group and is readily differentiated by having the aristae pubescent; femora brown to blackish medianly, yellow on apices; only one preapical dorsal bristle on hind femur and one anteroventral on hind tibia; fifth sternum short, broad, densely bristled (fig. 88a), and surstyli poorly developed (fig. 88b).

MALE. *Head*: Broader than high as seen in direct frontal view, silvery white pollinose except for the compound eyes, and with the interfrontalia rufous to brownish red in background, rather lightly gray dusted. Ocellar triangle slender, long pointed, extending to a level nearly halfway between upper and lower inferior frontal orbitals. Third antennal segment mostly dark brown to black, broadly yellow basally. First two segments yellow to rufous, tinged with brown. *Thorax*: Densely gray pollinose with rather faint brown vittae down dorsocentral lines and with one down median portion. Two strong pairs of presutural dorsocentrals present and also with two strong intraalar bristles. *Legs*: Mostly yellow with front femur broadly brown in ground color through median portion and densely gray pollinose. Mid and hind femora tinged with

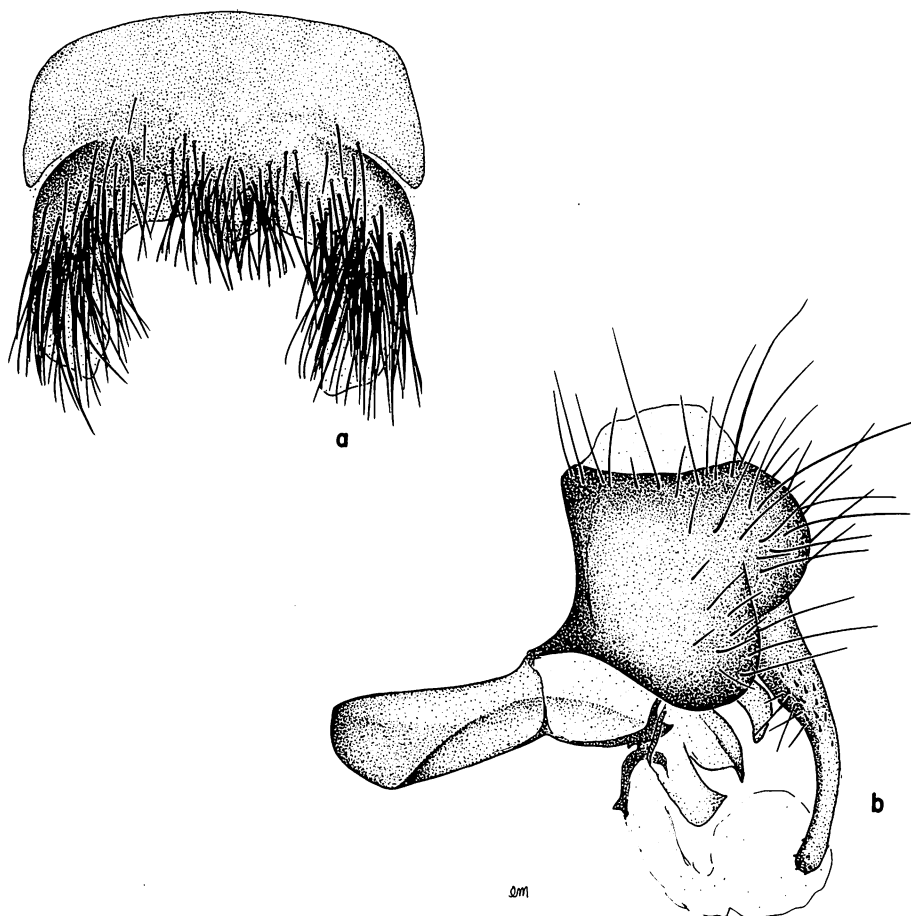


Figure 88—*Lispocephala chaetoloma* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

brown to blackish in median portions. Hind femur with one preapical dorsal and hind tibia with one anterior (or almost anteroventral) bristle situated at about apical three-fifths of segment. *Wings*: Subhyaline, with the r-m crossvein situated very slightly beyond middle of cell 1st M_2 . Calypters white. *Abdomen*: Basal three segments broadly yellow on sides, brown, dusted with gray over median portions. Terga 4-6 black in ground color, densely gray pollinose, and with faint indications of brownish paired spots on 3-4; the brown areas are opaque, not subshining. Fifth sternum densely bristled on apical half as in figure 88a. Extension from cercus slightly bent downward, having no strong ventral teeth before apex but with numerous short spines on upper basal portion and a clump of long ventral setae near base. Surstylus represented by a short-pointed projection as in figure 88b.

Length: body, 5.2 mm.; wings, 4.5 mm.

FEMALE. Unknown.

Holotype male: Waikamoi, Maui, 4,000 ft., July 1956 (R. Namba). One male paratype: Paliku, Haleakala Crater, Maui, 6,500 ft., July 1962 (D. E. Hardy).

Type in B. P. Bishop Museum. Paratype in University of Hawaii collection.

***Lispocephala comata* Hardy, new species (figs. 89a,b)**

Fitting in the *atratypes* complex of species by having the legs mostly dark brown to black, the abdomen with large subopaque, paired, black spots on terga 2-5; females having short, thick ventral spinules on front and middle femora, and legs of male lacking these spinules. The markings on the thorax are very similar to those of *ocellata* n. sp. from Maui, Molokai, and Lanai, but the hind femora have preapical dorsal bristles and the bristles along margins of fifth sternum are in a single row, more nearly like that of *atratypes*. It is readily differentiated from the above two species by having the surstyli developed, but small and fifth sternum of male broadly rounded, not so distinctly incurved at apices (fig. 89b). It appears related to *comparata* n. sp., from Kauai, and is differentiated by the male having preapical dorsals on hind femora and the surstyli and fifth sternum different in development (figs. 89a,b and 90a,b).

MALE. *Head*: Just slightly wider than high. Interfrontalia opaque, reddish brown to blackish, and ocellar triangle extending to a level about half-way between lower superior fronto-orbitals and upper inferior fronto-orbitals. Antennae entirely black. Aristae long pubescent to short plumose. Palpi brown to black at apices, yellow basally, and rather thickly black setose. Other details of

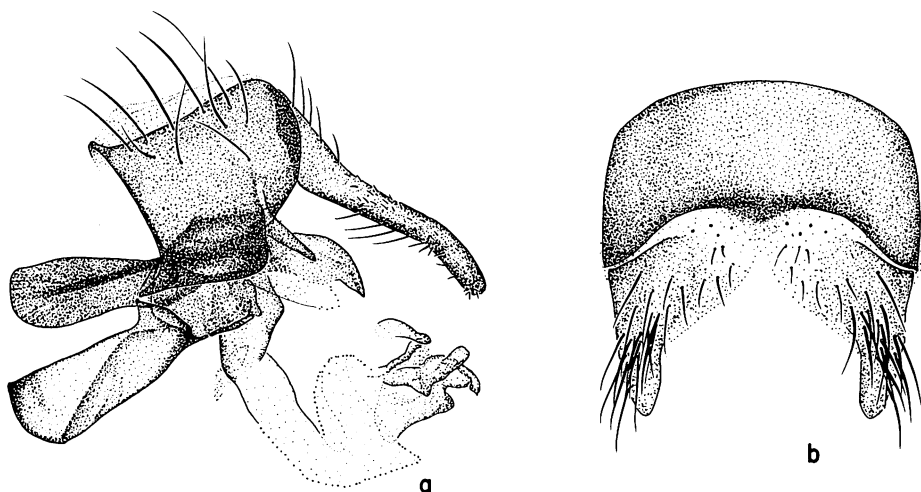


Figure 89—*Lispocephala comata* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

legs and body as in *atratypes* or as noted above. Lobes of fifth sternum broadly rounded at apices and with numerous moderately strong bristles along margins (fig. 89a). Genitalia as in figure 89b, surstylus short, compared to most *Lispocephala*, sharp pointed.

Length of body, 5.0 mm.

FEMALE. Two female specimens on hand seem to be associated with the males, they contain the same data as the type but I see no way to differentiate them from *atratypes*. They are not being designated as part of the type series.

Holotype male and two male paratypes labeled Kau, Hawaii, 4,000 ft., no date or collector given. Also two male paratypes, Kilauea, Hawaii, July 1903 (no collector given).

Type, one paratype, and the two female specimens in B. P. Bishop Museum. Other paratypes in collections of U.S. National Museum and University of Hawaii.

***Lispocephala comparata* Hardy, new species (figs. 90a,b)**

Fitting in the *atratypes* complex of species by having the legs predominantly black; abdominal terga with large, paired, black spots; one anteroventral bristle on hind tibia; and females with ventral spinules on femora, which males lack. Because of the development of the fifth sternum, it appears related to *comata* n. sp., from Hawaii, but the males lack preapical dorsal bristles on hind femora and lobes of fifth sternum are broadly rounded with comparative fine setae along margins (fig. 90b), not with a clump of prominent bristles (fig. 89b), also the surstyli much smaller, poorly developed (figs. 90a, 89a).

MALE. *Head:* Just slightly wider than high with interfrontalia opaque black; orbits, also lower portion of frontal triangle, which extends slightly beyond the level with upper fronto-orbital bristles, gray pollinose. Antennae and palpi black, the latter tinged faintly with rufous. Aristae short plumose. *Thorax:* Mesonotum colored as in *ocellata* n. sp., gray with brown vittae and scutellum gray, brown on sides in area of basal scutellars. *Legs:* Similar to those of *ocellata*, with preapical anterodorsal and posterodorsal bristles on hind femora but no preapical dorsals present. Bases of tibiae yellow, the remainder of tibiae brown to black, tinged with rufous. *Abdomen:* Similar to others of the *atratypes* complex, except lacking paired spots on second tergum; fifth sternum broadly rounded at apices and with rather fine setae on margins (fig. 90b). Genitalia as in figure 90a, with surstyli represented by small, triangular lobes.

Length of body, 4.5–5.0 mm.

FEMALE. Fitting most of the characteristics of the male except that preapical dorsal bristles are present on hind femora and paired, brown to black spots are present on the second tergum. It is differentiated from other members of the *atratypes* complex by having sides of first two terga broadly yellow; also the ventral spinules on the front and middle femora are less numerous, not so prominent as in most members of this group.

Length of body, 5.0–5.3 mm.

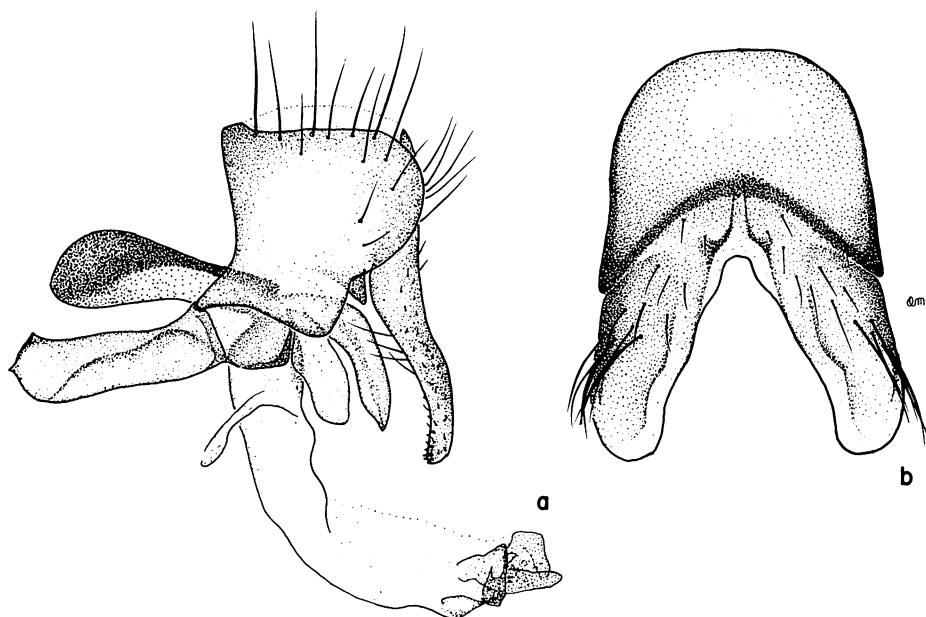


Figure 90—*Lispocephala comparata* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

Holotype male and allotype female: Kokee, Kauai, 3,600 ft., July 1952 (D. E. Hardy). Forty-two paratypes, sexes evenly distributed from the following localities on Kauai: same as type; Kainamanu, 3,800 ft., July 1952 (D. E. Hardy); Halemanu, August 29, 1921 (Swezey); Mt. Waialeale Trail, 4,500 ft., August 1953 (D. E. Hardy); Poomu Valley, 3,400 ft., July 1952 (D. E. Hardy); Kalalau, August 20, 1921 (Swezey); Mohihi Stream, near Alakai Swamp, July 30, 1963 (D. E. Hardy); Nualolo Valley, 3,400 ft., July 1952 (D. E. Hardy); Halemanu Swamp, August 1953 (D. E. Hardy); Alakai Swamp, 3,800 ft., July 1952 (D. E. Hardy); near Waiakoalae Stream, 2,700 ft., June 1964 (D. E. Hardy); Mohihi Ridge, July 1940 (E. H. Bryan, Jr.); Kokee, July 25, 1940 (E. H. Bryan, Jr.) and April 2, 1961 (D. F. Hardwick); and Kaholuamanu, 3,700 ft., April 4, 1920 (J. A. Kutsche).

Type, allotype, and series of paratypes in B. P. Bishop Museum; other paratypes in collections of U.S. National Museum, British Museum (Natural History), Canada Department of Agriculture, and University of Hawaii.

***Lispocephala eximia* Hardy, new species (figs. 91a,b)**

Fitting in the atratipes complex of species by the peculiar development of the male genitalia, with lobes of fifth sternum incurved at apices, surstyli lacking, and aedeagus tubular at apex (fig. 91b); also by the large, prominent, paired spots on abdominal terga. It differs by having the legs all yellow except for

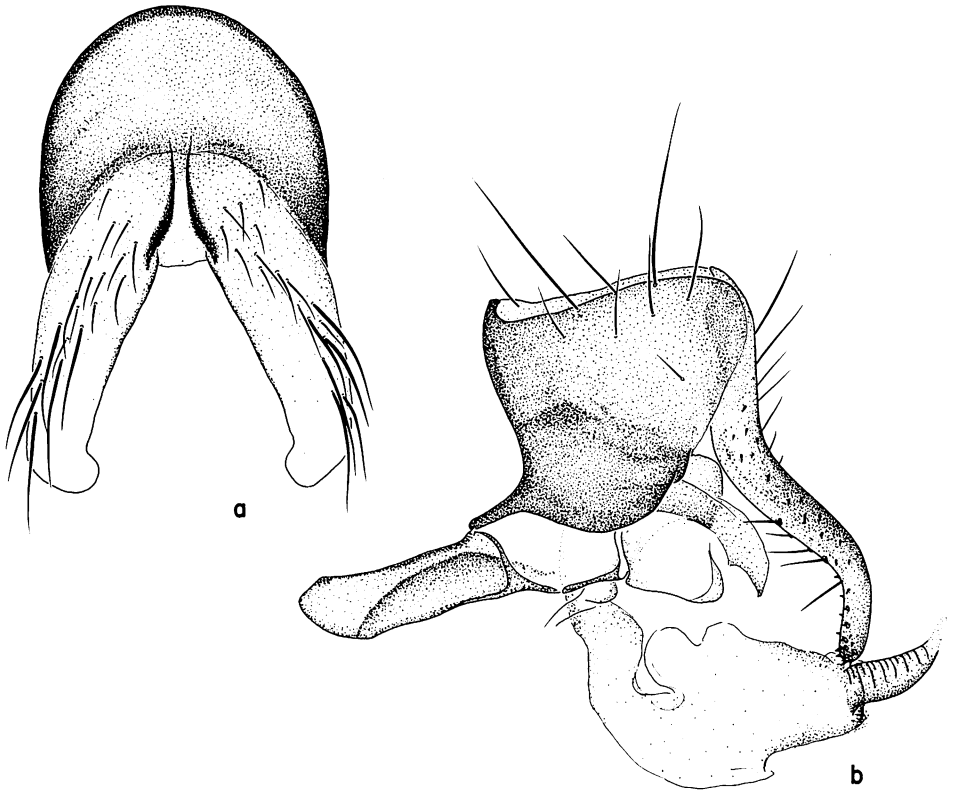


Figure 91—*Lispocephala eximia* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

apices of hind femora; palpi yellow, not black; mesonotum gray with brown vittae, not mostly brown; ocellar triangle extending slightly beyond upper, inferior fronto-orbital bristle, rather than just slightly beyond lower superior fronto-orbital; also the lobe on each side of apex of fifth sternum is less prominent (fig. 91a), and the tubular apical portion of the aedeagus more tapered, slender, wrinkled ventrally (fig. 91b). It resembles *chaetoloma* n. sp., from Maui but the male genitalia are very different (figs. 88a,b and 91a,b). In the key the males would fit near *triangulifera* (Grimshaw), but the striking differences in the genitalia will readily differentiate these. The female fits in the grouping with short, thick, black, ventral spinules on front and middle femora and runs near *brevispina* Malloch, from Maui. It is differentiated by having two strong intraalar bristles, mid and hind femora brown at apices; third antennal segment entirely black and ocellar triangle extending to about level with upper, inferior fronto-orbitals.

MALE. *Head:* Slightly wider than high, mostly gray pollinose, brown on upper median portion of vertex, ocellar triangle, upper vertex and upper one-half

to three-fifths of ocellar triangle; lower portion of triangle gray and extending to about level with upper superior fronto-orbitals. Interfrontalia dull brown to blackish in ground color, lightly gray pollinose. Antennae entirely black except for yellow apices of first two segments. Arista moderately plumose. Palpi entirely yellow. *Thorax*: Densely gray pollinose with three brown vittae down middle of mesonotum. Two strong intraalar bristles present. Dorsal portion of scutellum with numerous black setae. *Legs*: Predominantly yellow with apices of hind femora broadly brown to blackish and with the tarsi tinged with brown to black. One strong anteroventral bristle present at middle of hind tibia, this is equal in size to the preapical anterodorsal. One prominent preapical dorsal on hind femur. *Wings*: Subhyaline, r-m crossvein situated just slightly beyond middle of cell 1st M_2 . I see nothing distinctive about the venation. Calypters white. *Abdomen*: Mostly black in ground color with first two terga broadly yellow on sides, brown medianly. Other terga densely gray pollinose, obscuring the brown color except for the opaque black, paired spots; these are large and conspicuous on terga 2-5. Fifth sternum deeply cleft on hind margin, the concavity extending half the length of the segment and with a small incurved lobe developed on each side at apex (fig. 91a). Surstyli completely lacking and extension from cercus with prominent ventral setae on middle portion and gently curved downward apically. Aedeagus tube-like at apex as in figure 91b.

Length of body and wings, 4.75 mm.

FEMALE. Fitting description of male in general respects but with ocellar triangle entirely brown except for apical portion. All femora tinged with brown before apices. Front and middle femora with short, thick, spines rather abundant over the anteroventral surface on basal third to two-fifths of segments. Abdomen densely gray pollinose, except for the large opaque black spots on terga 2-5, and almost entirely black in ground color. The yellow on the first two terga confined to lateral basal portions.

Length of body and wings, 5.0-5.2 mm.

Holotype male: North slope, Hualalai, Hawaii, 4,000-6,000 ft., July 1953 (D. E. Hardy). Allotype female: Hinakapaulo, Hualalai, Hawaii, July 19, 1964 (D. E. Hardy). Three paratypes, two male and one female, same data as type.

Type and allotype in B. P. Bishop Museum. Paratypes in University of Hawaii collection.

***Lispocephala kaalae* Williams**

Lispocephala kaalae Williams, 1938, Proc. Haw. Ent. Soc. 10(1):118, fig. 1.

Endemic. Oahu (type-locality: Mt. Kaala). Type female in B. P. Bishop Museum. Known only from five female specimens collected on mosses on slopes of Mt. Kaala by F. X. Williams, July 1933-1938. Evidently associated with native Dolichopodidae; one was captured feeding on a *Campsicnemus* sp.

The females fit in the brevispina group of species because of the presence of short, thick, ventral spinules on femora and belong in the atratipes subgroup

and the *argentifrons* complex; characterized by having the palpi, antennae, and legs black, no anteroventral bristles on hind tibia, one preapical dorsal bristle on hind femur, in addition to the preapical postero- and anterodorsals and calypters white. A complex of species from all the main islands fit here and the females are characterized by having the mesonotum and dorsum of scutellum entirely brown pollinose with no gray markings and abdomen black, broadly gray pollinose at apices of terga with no evidence of paired spots.

Only females of *kaalae* have been seen and it is probable that the males fit in the group which lack thickened, ventral spinules on femora, and they would be characterized by having the palpi and legs predominantly black and hind tibiae lacking anteroventral bristles.

The front and vertex are entirely golden brown pollinose, the ocellar triangle is scarcely differentiated and extends over most of the length of the front. The humeri and rather broad lateral margins of the mesonotum are gray and the pleura entirely gray. The original description of Williams is adequate for the female.

Length of body, 4.0–4.25 mm.

***Lispocephala kaalae* complex, new species? 'A' and 'B'**

A series of female specimens from Hawaii fit the description of *kaalae*, except that the interfrontal area is opaque, velvety black, contrasting from the brownish pollinose parafrontals and ocellar triangle. The thorax including most of the humeri is completely brown pollinose over the dorsum, except for a small mark of gray around notopleural bristle. Also, the posterodorsal portion of the mesopleura is brown. I see no other characters for separating it and males are needed to clarify its position.

Two female specimens from Upper Hana Forest, 5,675 ft. and Koolau Forest Res., 6,000 ft., Maui, June–July 1973 (C. W. Whittle) seem to represent a third species (n. sp.? 'B'). Having the entire front densely golden-brown pollinose, as in *kaalae*, but having the parafacials brown, contrasting from the silvery-gray face, mesonotum including humeri entirely dark brown pollinose. The mesopleuron is as in n. sp.? 'A'.

***Lispocephala ocellata* Hardy, new species (figs. 92a–c)**

Fitting in the *atratypes* complex of dark-legged species which have short, thick, ventral spinules on front and middle femora of female but lack these in the male. Fitting near *atratypes* Malloch, from Hawaii, by having large, paired, black spots on abdominal terga, calypters white, only one anteroventral bristle on hind tibia, and fifth sternum of male with a prominent, rounded lobe on each inner apical margin (fig. 92b). The males are differentiated from *atratypes* by having the mesonotum gray, with distinct brown vittae; scutellum gray, slightly brown on the sides; hind femur with preapical anterodorsal and posterodorsals but no dorsal bristles; and fifth sternum more densely setose along margins, having 2–3 rows of setae along sides (fig. 92b).

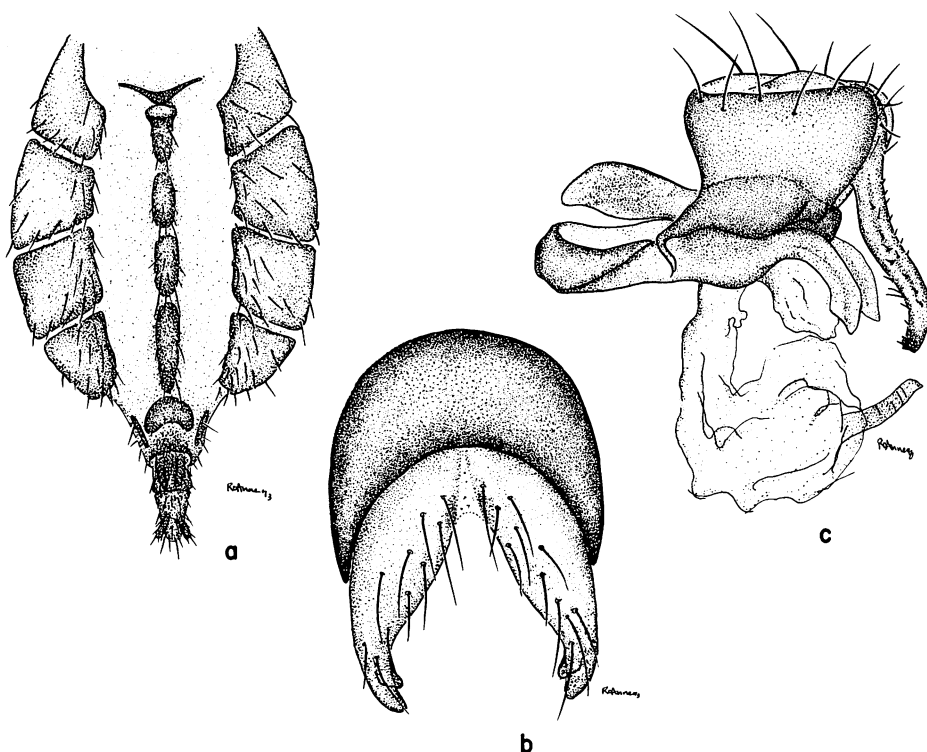


Figure 92—*Lispocephala ocellata* n. sp.: a, female abdomen, ventral; b, fifth sternum of male; c, male genitalia, lateral.

MALE. Head: Slightly wider than high, fitting most of the characteristics of *atratiipes* except that the genae are not as broad; measured from lower eye margin to vibrissae, the distance is about equal to the width of third antennal segment, and the ocellar triangle extends to a level with upper inferior fronto-orbital bristles. **Thorax:** Gray pollinose with five pale brown vittae, the lateral pair, in line with intraalar bristles, is interrupted at the suture, and the middle vitta extends to about level with second pair of postsutural dorsocentrals. Scutellum mostly gray, brownish pollinose on sides in area occupied by basal scutellars. Two pairs of strong intraalars present. Calypters entirely white. **Legs:** As in *atratiipes*, except that the preapical dorsal bristle is lacking on hind femur. **Wings:** Subhyaline. I see nothing distinctive about the venation. **Abdomen:** Colored as in *atratiipes*, largely gray with four pairs of large, subopaque black spots arranged on terga 2-5. Fifth sternum similar in shape to *atratiipes* with the small subapical lobe developed on each side but more thickly setose on sides with two to three irregular rows of setae (fig. 92a). Other details of genitalia as in figure 92c.

Length: 4.75-5.25 mm.

FEMALE. Fitting description of *atratiipes* except that the thorax is typically gray with brown vittae and the scutellum is usually gray down median portion. The coloration of the thorax is apparently not reliable in the female, considerable variation has been observed. One preapical dorsal bristle is present on hind femur, in addition to the preapical anterodorsal and posterodorsals. Two specimens have been seen which lack the dorsals, as in the males. Female abdomen, ventral view, as in figure 92a.

Length of body, 5.25–6.0 mm.

Holotype male: Manawainui Valley, Molokai, August 1953 (M. Tamashiro).

Allotype female: same locality as type, July 1952 (D. E. Hardy).

Fifty-eight paratypes, 16 males and 42 females, from the following localities: Molokai: same as type, Puu Kolekole, July 1952 (D. E. Hardy); Puu O Kaeha, July 1953 (D. E. Hardy); Puu Alii, July 1953 (M. Tamashiro); Kewela Gulch, 3,500 ft., March 1966 (J. W. Beardsley). Maui: Paliku, Haleakala Crater, 6,500 ft., June 1952–1953 (C. R. Joyce and D. E. Hardy); Olinda, February 1926 (O. H. Swezey); Haleakala Crater rim, 8,000–9,500 ft., August 1952 (J. W. Beardsley); Haleakala Crater, June–July 1952 and 1956 (D. E. Hardy, R. H. van Zwaluwenburg); Iao Valley, February 1925 and June 1952 (F. X. Williams and D. E. Hardy); Puukukui, 3,000–3,500 ft., June 1953 and July 1956 (C. R. Joyce and R. Namba).

Also one female on hand: Lanaihale, Lanai, 3,200 ft., June 1963 (D. E. Hardy).

Type, allotype, and some paratypes in B. P. Bishop Museum. Other paratypes in collections of U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala parva* Hardy, new species (figs. 93a,b)**

Fitting in the *atratiipes* subgroup which have the male surstyli rudimentary and in the complex which have one preapical dorsal bristle on the hind femur and one anteroventral on the hind tibia. It is probable that the femora of the females have ventral spinules. It fits near *chaetoloma* n. sp. and *eximia* n. sp. but differs by having the femora dark reddish brown and the male genitalia different in development. The rudimentary surstyli (fig. 93a) are similar to those of *chaetoloma* but the fifth sternum is completely different (cf. figs. 88a,b and 93a,b).

In the key, it runs near *rufibasis* Malloch but differs by having the aristae short plumose, wings hyaline, first three abdominal segments nearly all yellow and about half the size of that species (body, 3.75 mm. as compared to 6.3–6.5 mm. for *rufibasis*). It is also probable that the male surstyli are well developed in *rufibasis* and that it falls in a different species group. The males have not been seen.

MALE. *Head*: Entirely gray pollinose except for the compound eyes and with the interfrontal area more lightly pollinose so that the dark reddish brown to

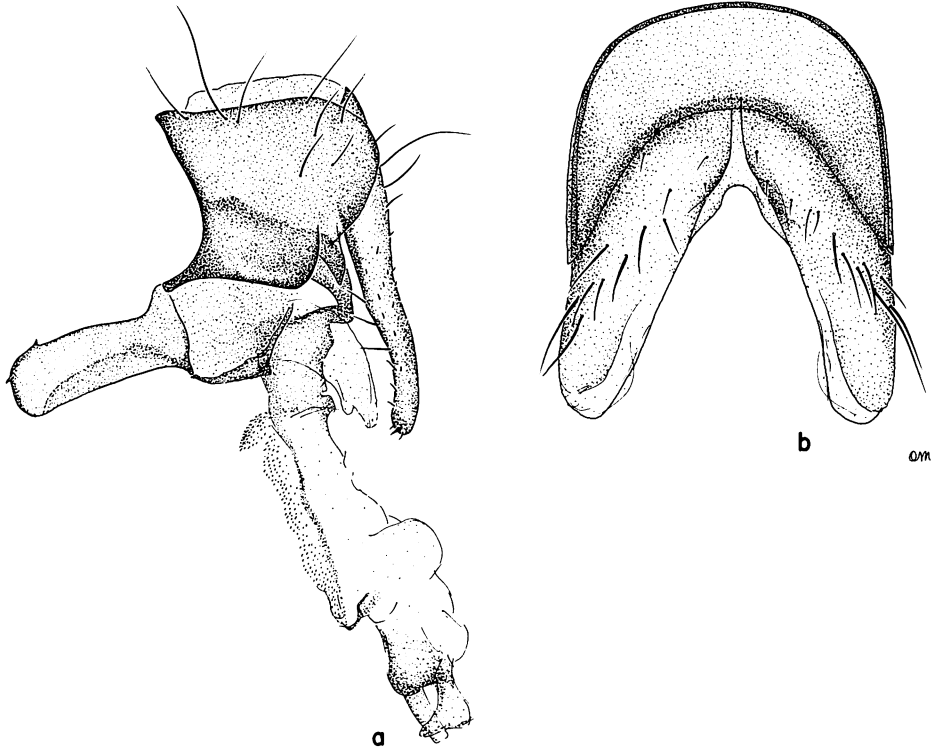


Figure 93—*Lispocephala parva* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

blackish brown color shows through. Ocellar triangle extending to about one-third the distance between the upper and lower inferior fronto-orbitals. The upper inferior fronto-orbitals are comparatively small, much smaller than is normal in *Lispocephala* and are but slightly longer than the dorsal bristles on the second antennal segment. Only one small seta present on hind portion of ocellar triangle, between the posterior ocelli. Antennae dark brownish red with aristae short plumose on basal half, the longest hairs equal to one-half to two-thirds the width of third segment. *Thorax*: Rather densely gray pollinose with faint indications of brown vittae down dorsocentral lines. Anterior intraalars well developed. *Legs*: Femora dark reddish brown, gray pollinose or pubescent. Tibiae mostly tinged with brown, broadly yellow basally. Only one preapical dorsal bristle on hind femur and hind tibia with one anteroventral just beyond middle of segment. *Wings*: Hyaline. I see nothing distinctive about the venation. Calypters hyaline with the rims white. *Abdomen*: With first three terga all yellow except for a faint, longitudinal, brown vitta down middle. Fourth tergum yellow on basal lateral margins, abdomen otherwise dark reddish brown to blackish in ground color, covered with gray pollen, and with shining brown to black, paired spots on terga 4 and 5. Surstyli rudimentary,

represented by only a small projection on each side, and process from cercus strongly bent downward at apex (fig. 93a). Fifth sternum shaped as in figure 93b.

Length of body, 3.7 mm.

FEMALE. Unknown.

Holotype male: Kumuwela, Kauai, July 8, 1925 (O. H. Swezey).

Type in B. P. Bishop Museum.

PALLIDIBASIS GROUP OF SPECIES

With posteromedian bristle on front tibia (fig. 103d). This may be absent in males of some species of the seminigra subgroup and in *villosifemora* n. sp., *dexioides* subgroup. In the pallidibasis and the dexioides subgroups, the head is narrow; only one distinct intraalar bristle is present; mid tibia with only one posterior and no anterior bristle near middle of segment, and hind femur lacking preapical dorsal bristles.

PALLIDIBASIS SUBGROUP

Differentiated by having the legs entirely black; basal three terga of male almost entirely pale yellow or yellow-white and abdomen of female shining black with narrow gray pollinose apices of terga.

Lispocephala bispina Malloch (figs. 94a-c)

Lispocephala bispina Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):75.

Endemic. Oahu? (Type-locality: unknown. Type labeled only "Full-away.")

Type female in B. P. Bishop Museum.

Fitting in the pallidibasis subgroup of species near *pallidibasis* Malloch and differentiated by having the bases of tibiae yellow. Females: with mesonotum gray with three brown median vittae; first two abdominal terga yellow, except for a small marking of brown down median portion and basal portion of third tergum of female almost entirely yellow; also the black markings on terga 3-5 in the females are indistinctly divided by brown pollen through median portions. Males: with palpi yellowish at apices and female palpi yellowish basally, sometimes entirely yellow with a faint tinge of brown. The extreme apices and bases of the femora in females are sometimes yellow, and in typical females, the front coxae and all trochanters are yellow in ground color, faintly tinged with brown. The type female (locality unknown) has the front tibiae almost entirely yellow, tinged with brown on apical halves, also the palpi are entirely yellow. This may be slightly teneral. A series of specimens on hand from Oahu typically have the front tibiae mostly brown, tinged with yellow on apical halves, yellow basally, and the palpi vary from all yellow, tinged with brown at apices, to brown apically with bases yellow. The male mesonotum is broadly

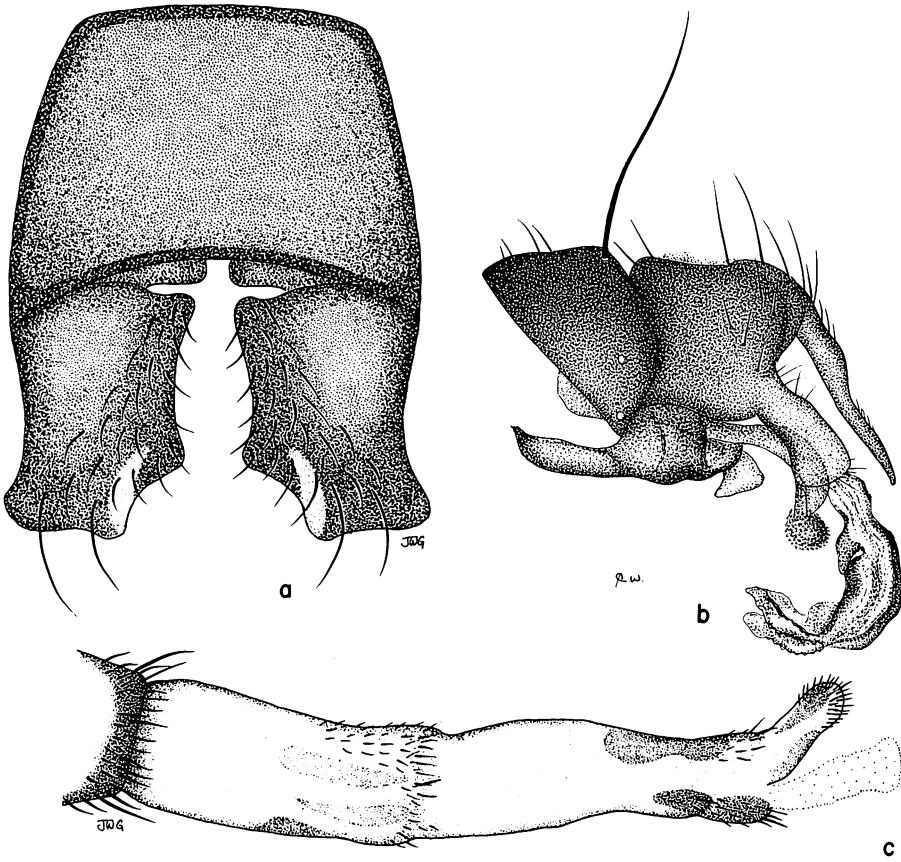


Figure 94—*Lispocephala bispina* Malloch: a, fifth sternum of male; b, male genitalia, lateral; c, apical portion of female abdomen, lateral.

gray on margins, subshining brown across the median portion, with the brown marking extending from near anterior dorsocentral bristle to a level with posterior dorsocentrals; before the suture the brown markings extend laterally about halfway between the dorsocentral rows and on a level with the posthumeral bristles, and behind the suture the marking extends laterally to the supraalar bristles. In the male, the posteromedian bristle of the front tibia is short, straight, hair-like, and sometimes inconspicuous, extending scarcely over one-fourth the distance to apex of segment. In female, the posterior bristle of front tibia is strong, extending beyond apex of segment, and the ventral bristle of hind tibia is long and curved, extending well beyond apex of segment. The ventral bristle of hind tibia is also fine and straight in male, extending about half the distance to apex. Hind femora of male densely covered with moderately long, fine hair over ventral surface with some of the hairs near

apical third about as long as anteroventral and anterodorsal bristles. Male abdomen with basal three segments mostly yellow, brown on anterior margin of first and posterior margin of third, and with a faint tinge of brown through median portion of third. Male genitalia as in figure 94b, the lobes of fifth sternum are rather truncate apically (fig. 94a). The terminal sclerites of the female abdomen are elongate and slender (fig. 94c).

Length of body, 7.0–8.0 mm.

Specimens have been reared from rotting bark of *Urera kaalae* and *sandwicensis* and from rotting stems of *Pisonia*, on Oahu, in association with larvae of native *Drosophilidae*.

The Oahu population seems to best fit the concept of this species. It is probable that a complex of species may be involved in this concept. Two females from Puu KOLEKOLE, Molokai and one female from Waikamoi, Maui seem to fit here.

***Lispocephala hamifera* Hardy, new species (figs. 95a,b)**

Belonging in the pallidibasis subgroup by having a posterior bristle near middle of front tibia, in combination with the legs predominantly black, and so on. Fitting near *zonata* n. sp. and differing by the peculiar development of the male genitalia, bearing a strong hook-like process on dorsal surface of the cercus (fig. 95a); male antenna with the third segment rufous, tinged with brown, rather than clear yellow. The female is very close to *zonata* and I am not certain that these can be clearly differentiated. The specimens of *hamifera* on hand appear to differ from those of *zonata* by having the pale pollinosity of the mesonotum, scutellum and abdomen golden gray, and the wings nearly subhyaline, not intensely brown fumose and with only faint indications of brown in the anterior area. In *zonata* the wings are mostly brown fumose, subhyaline posteriorly and basally.

MALE. Fitting the characteristics of most of the members of this subgroup except as noted above. *Head*: The aristae are almost bare, with short pubescence only on about the basal third. Palpi rufous with a faint tinge of brown especially on apices. *Thorax*: Mesonotum with only two brown vittae, these extend along the dorsocentral rows. Only one intraalar bristle. Calypters hyaline with rims faintly yellowed. *Legs*: Black, except for very narrow apices of femora and bases of tibiae. Posterior bristle near middle of front tibia extending about two-thirds the distance to apex of segment and approximately equal in length to preapical dorsal bristle of tibia. Front basitarsus with two or three long ventral hairs at base and with a row of erect posteroventral hairs extending the full length. Elongate preapical postero- and anteroventral hairs are present on each tarsomere, except for the apical one. Posterior bristle in middle of middle tibia short, extending about one-third the distance to apex of segment. Anteroventral bristle of hind tibia extending almost to apex of segment and subequal in length to preapical dorsal bristle. Hind femur lacking the

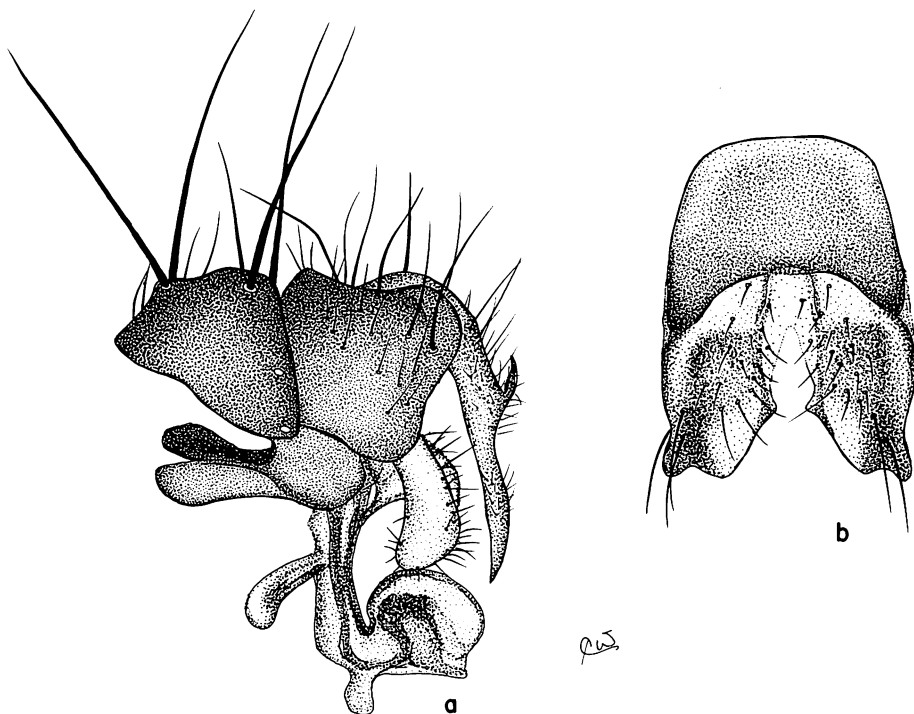


Figure 95—*Lispocephala hamifera* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

long, fine, ventral hairs characteristic of *pallidibasis* and *bispina*. *Abdomen*: Densely yellow gray pollinose except for the opaque brown to black markings on terga. Terga 1 + 2 all yellow except for a brown vitta down middle. Third tergum yellow except for an opaque dark brown to black spot over middle; fourth broadly yellow basally with a quadrate dark brown to black mark over dorsal portion; fifth with a quadrate mark over apical three-fourths; and sixth with a brown band over median portion. I see nothing distinctive about the bristling of the abdomen. As seen in end view, the opaque marks on terga 3–5 are faintly divided into spots, these are not visible from direct dorsal view. Fifth sternum shaped as in figure 95b, lacking bristles and sparsely setose. Genitalia as in figure 95a with the strong dorsal hook on the cercus characteristic of the species. The other details are similar to other species of the *pallidibasis* subgroup.

Length: body, 8.3 mm.; wings, 7.0 mm.

FEMALE. Fitting very close to *zonata* n. sp. and apparently differentiated by the characters given in the key above; I cannot be certain, however, that these are reliable and further specimens will need to be studied.

Holotype male, allotype female, and two female paratypes: Waikamoi,

Maui, August 20, 1969, 4,000 ft., reared ex rotting *Clermontia* bark (S. L. Montgomery).

Type and allotype, B. P. Bishop Museum, paratypes in University of Hawaii collection.

***Lispocephala ingens* (Grimshaw) (figs. 96a-d)**

Coenosia ingens Grimshaw, 1901, Fauna Hawaiiensis 3(1):40.

Endemic. Molokai, Maui, Hawaii (syntype series, all females from these islands); also Oahu. Syntype series in British Museum (Natural History).

Biology: Evidently general predators, specimens have been reared from rotting bark of *Cheirodendron* and from rotting bracket fungi in association with native *Drosophila*.

Fitting the pallidibasis group characterized by having a posterior median bristle on front tibia in combination with legs all black, body of female entirely shining black, and abdomen of male with basal three segments mostly yellow-white. It shows closest relationship to the pallidibasis complex but is immediately differentiated from all known *Lispocephala* by the comparatively densely setose front and upper median portion of vertex (fig. 96a); genae densely bristled with two or more rows of bristles or strong hairs, rather than just a single row of vibrissae; sternopleura densely setose; upper margin of hypopleuron with several (3-6) long black hairs; also mesonotum and disc of scutellum thickly covered with long fine hairs, especially in males. The area of the vertex immediately above ocellar triangle has about a dozen long hairs. It is further differentiated from pallidibasis complex species by having two strong intraalar bristles; rim of upper calypter brown; apical portion of male surstylus long, slender, parallel-sided (fig. 96b), and aedeagus weakly sclerotized apically.

Populations which appear to be *ingens* have been collected from four of the main islands and this may well represent a species complex; however, reliable characters have not yet been found for differentiating these and at present we must assume that this is a widespread species.

Antennae and palpi entirely black in both sexes. Front with two rows of closely spaced bristles or bristle-like hairs, more numerous in males, and lower half to two-thirds of each gena densely covered with bristles and bristle-like hairs, especially in males. Posterior half of each mesopleuron densely covered with long, thin, black hairs and upper posterior portion of each sternopleuron, especially area bounded by the triangle, densely covered with long, thin, black hairs. An extra sternopleural bristle is often present, especially in males directly above the bristle of the lower part of the triangle. The mesonotum is mostly shining black, very lightly gray pollinose over dorsum, densely gray pollinose on extreme lateral margin and over humeri. Posteromedian bristle of mid tibia as in figure 96d. Femora densely covered with long black hairs, especially on venter (fig. 96c). Abdomen of male with first tergum usually all brown to black

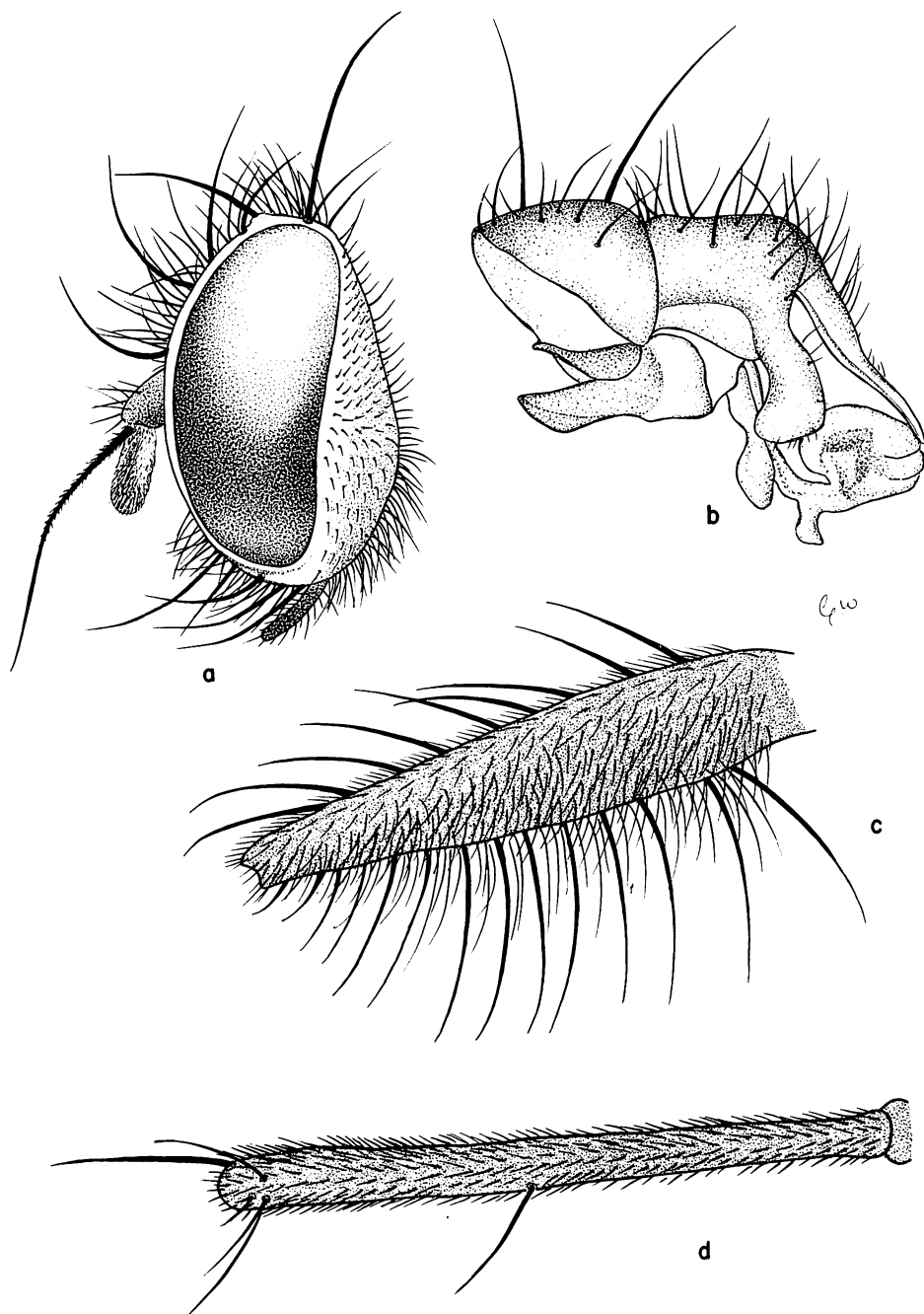


Figure 96—*Lispocephala ingens* (Grimshaw): a, head; b, male genitalia, lateral; c, front femur, posterior surface; d, middle tibia, dorsal view.

and second, third, and basal portion of fourth terga yellow-white except for a narrow streak of brown to black extending down middle. Apical portion of fourth and all of fifth tergum, as well as terminalia, black in ground color. Entire abdomen rather densely yellowish to yellow-gray pollinose. Female abdomen entirely polished black with narrow gray pollinose apices on terga and thinly gray pollinose over sides. Male genitalia as in figure 96b.

Length of body, 7.0–8.5 mm.

***Lispocephala lanaiensis* Hardy, new species (figs. 97a,b)**

Fitting in the *pallidibasis* subgroup of species and fitting in the complex of species which have the mesonotum predominantly brown pollinose and hind femora lacking dense, fine, ventral hairs. In the key, it fits nearest *hamifera* n. sp. but is readily differentiated by having the antennae all black and the male genitalia lacking the strong, dorsal, hook-like process on cercus (fig. 97a). Because of the all black antennae of the male, it would superficially resemble *ingens* (Grimshaw) but the two are not related, as pointed out in the key above. The female specimens resemble those of *pallidibasis* Malloch and I see no way to differentiate these.

MALE. Fitting the general characteristics of most species of this subgroup. In the male specimens on hand, the third antennal segment is entirely dark brown to black and the palpi of the type are dark reddish brown and in the paratype

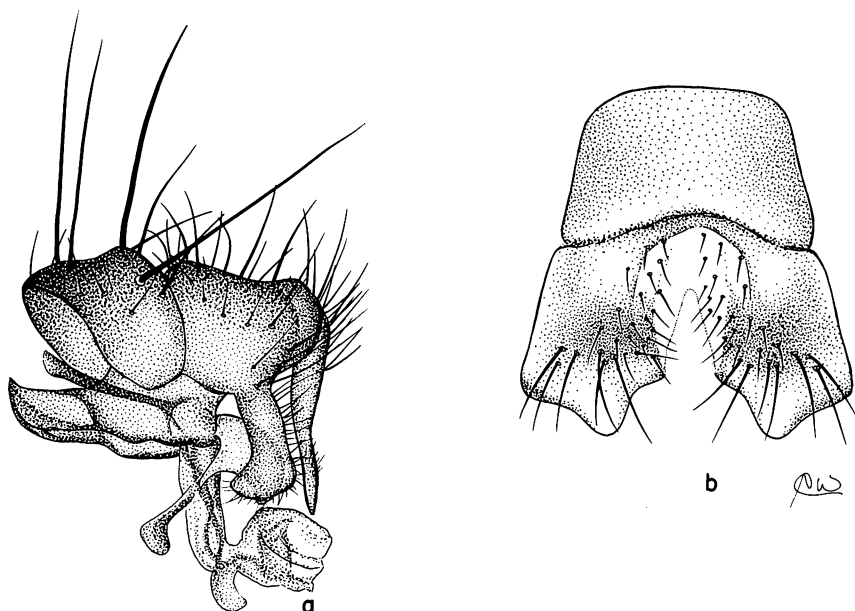


Figure 97—*Lispocephala lanaiensis* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

they are dark brown to blackish with a faint tinge of rufous. The mesonotum is broadly brown pollinose over the median portion, gray on margins, broadly so on posterior portion. In the type a pair of narrow, submedian, gray vittae extend the entire length. In the one paratype male these are not clearly indicated. Abdomen with the three basal segments entirely yellow except for brown markings over median portions and with base of fourth tergum broadly yellow. In end view terga 3-5 have large, paired, brown to black spots, these are not visible in direct light (dorsal view). Wings subhyaline, faintly tinged with brown. Fifth sternum as in figure 97b and male genitalia as in figure 97a.

Length: body, 7.0 mm.; wings, 6.0 mm.

FEMALE. Fitting description of *pallidibasis*. I see no satisfactory way to separate it.

Length of body, 7.5 mm.

Holotype male: Lanai Mts., Lanai, October 29, 1947 (N. L. H. Krauss). Allotype female: Lanaihale, Lanai, 3,300 ft., July 1, 1965 (D. E. Hardy). Three paratypes, one male and two females: two same locality and collector as allotype, one collected August 1965 and one reared ex *Sadleria* fern. One paratype: Kaiholena Valley, Lanai, June 7, 1971, 2,200 ft. (S. L. Montgomery).

Type and allotype in B. P. Bishop Museum, paratypes in University of Hawaii collection.

***Lispocephala pallidibasis* Malloch (figs. 98a-d)**

Lispocephala pallidibasis Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):73.

Endemic. Oahu (type-locality: Punaluu).

Fitting very near *bispina* Malloch. I see no apparent characters for separating the males except that the ones which seem to fit *bispina* have the apices of the palpi yellow whereas those in the *pallidibasis* series have the palpi all dark brown to black. The male specimens on hand under *bispina* have not been positively associated with the females and there is possibility of an error. The females of *pallidibasis* seem very distinctive from *bispina* and are easily differentiated by having the mesonotum almost entirely shining dark brown to black, gray only on extreme margins; also by having the abdomen entirely black, as seen in direct dorsal view, with the posterior borders of terga narrowly gray pollinose and the basal two terga yellow only on sides, as seen in lateral view. In *bispina*, the terga are predominantly densely yellow gray pollinose, obscuring the ground color except for the subshining black markings over the median portions of terga 2-5. The legs of *pallidibasis* are more consistently blackened, the front coxae are entirely black and the trochanters dark brown. The femora are entirely black except for a very narrow tip of yellow at apices. The mid and hind tibiae are brownish yellow basally and the front tibiae are distinctly yellow at their bases, brown to black over the apical two-thirds to three-fourths. The terminal sclerites of the female abdomen are distinctly shorter and thicker in *pallidibasis* (fig. 98b) than *bispina* (fig. 94c). Fifth sternum

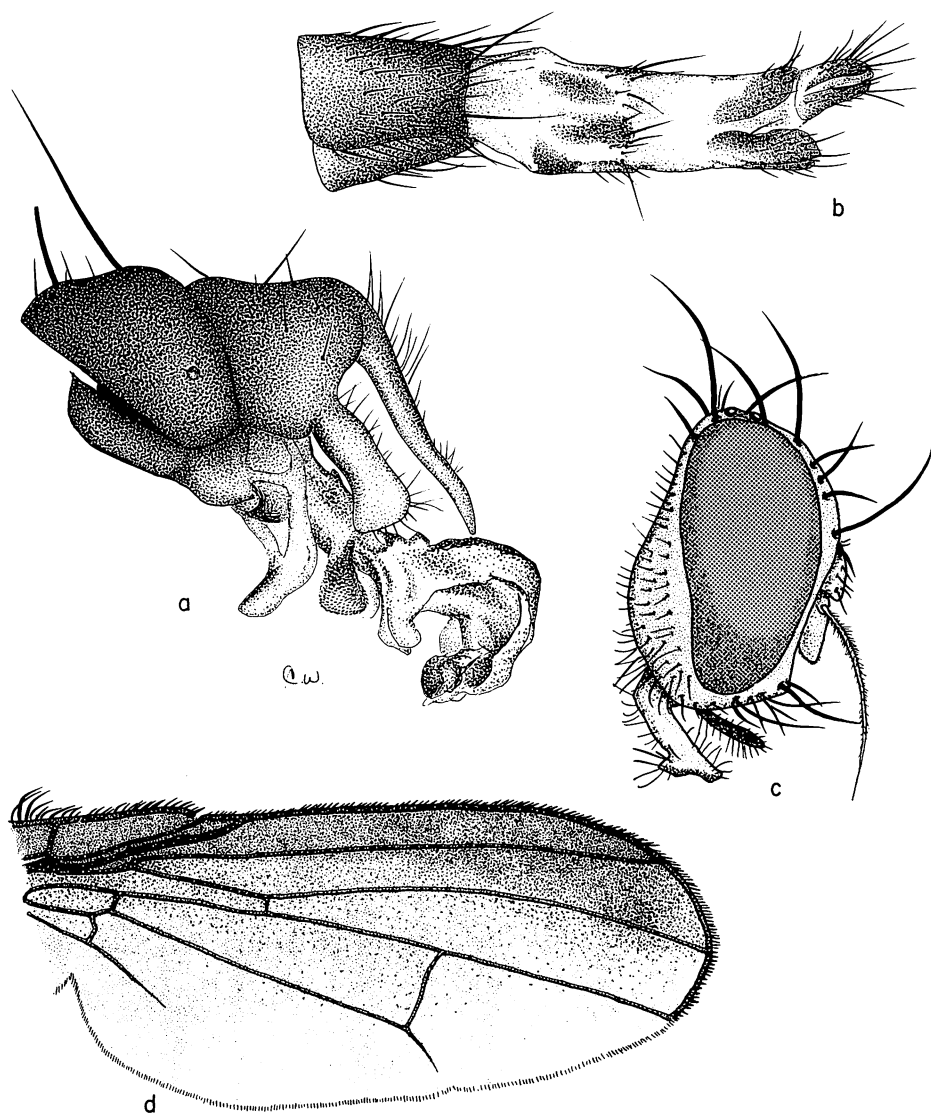


Figure 98—*Lispocephala pallidibasis* (Malloch): a, male genitalia, lateral; b, apical portion of female abdomen, lateral; c, head; d, wing.

of male similar to figure 94a and male genitalia as in figure 98a. Head as in figure 98c and wing as in figure 98d.

Length of body, 7.0–8.0 mm.

This has been reared from rotting stems of *Cheirodendron*, in association with larvae of native *Drosophila*. One specimen was feeding on an endemic tipulid when captured.

Lispocephala new species ? females pallidibasis-like #A

A series of female specimens on hand from various localities over the island of Hawaii fit *pallidibasis* Malloch, from Oahu. It is very probable that this is a distinct species but the males have not yet been seen and it cannot be differentiated from the female sex.

Lispocephala planifemorata Hardy, new species (figs. 99a-c)

Fitting in the *pallidibasis* subgroup of species by having the legs all black in both sexes, the abdomen all black in the females, and the third antennal segment of male yellow. It differs from other *Lispocephala* by having hind femora of male greatly thickened, flat, slightly concave on ventral surface, and densely covered with short black hair over the venter (fig. 99c). Also the hind tibia of the male lacks a ventral bristle but has a row of long bristle-like hairs down anteroventral surface. The male may be also differentiated by having the palpi entirely yellow.

In other details fitting the characteristics of most species in the group which has the posterior bristle on front tibia and legs predominantly or entirely black, the third antennal segment of the male yellow and palpi yellow, sometimes tinged with brown on basal portion. The extreme bases of front tibiae are yellow-brown. The mesonotum of the male is mostly gray with the large, brown, median spot centered at the suture, extending anteriorly almost to anterior dorsocentrals; behind suture the mark extends laterally to a level with the prescutellar bristles and the posterior portion is extended on each side to or slightly beyond the median pair of postsutural dorsocentrals. The calypters are almost white with the rims slightly yellowed. I see nothing distinctive about the male fifth sternum (fig. 99a) or genitalia (fig. 99b), the aedeagus is similar to that of *pallidibasis*. The female fits the characteristics of other members of this group with all black or brown to black antennae and palpi, mesonotum mostly shining black, and abdomen all shining black with narrow gray apices on the terga.

Length of body: male, 7.0–7.5 mm.; female, 7.5–9.0 mm.

Holotype male: Waikamoi, Maui, 4,000 ft., July 6, 1966 (D. E. Hardy). Allotype female: same locality July 26, 1972 (M. D. Delfinado). Ninety-five paratypes, 69 females and 26 males, from the following localities: Maui—same as type, March–October 1964–1966, some reared ex rotting *Clermontia* in association with native *Drosophila* and one preying on *Drosophila* (W. B. Heed, D. E. Hardy, H. T. Spieth); Waihoi Valley, 2,780 ft., July 1972 (W. Ibara); Kipahulu Valley, 3,000 ft., August 1967 (H. L. Carson); Puu Kukui Ridge, 3,000–4,000 ft., October 1966 (no collector given) and July 1971 (D. E. Hardy); Hanaula, 4,000 ft., July 1968–June 1972 (J. A. Tenorio, K. Y. Kaneshiro); Keanae Valley, 1,600 ft., December 1966 (D. E. Hardy); Haleakala, September 1963 (D. E. Hardy); Koolau Forest, 5,900 ft., July 31, 1973 (C. Whittle); Hoalua, 3,900 ft., July 1971 (D. E. Hardy); and Upper Hana

Forest, 5,600 ft., June 25, 1973 (C. Whittle). Molokai—Kainalu, 1,800–3,000 ft., July 1927 (E. H. Bryan Jr.); Wailau Pass, 3,000 ft., December 1937, one “eating leafhopper” (F. X. Williams); Mapulehu Gulch, 1,200 ft., February 1972 (S. L. Montgomery); Puu O Kaeha, July 1952 (D. E. Hardy); Puu Kolekole, July 1965 (H. L. Carson); E. Molokai Mts., 2,400 ft., November 1928 (F. X. Williams); and Hanalilolilo, July 1952 (D. E. Hardy).

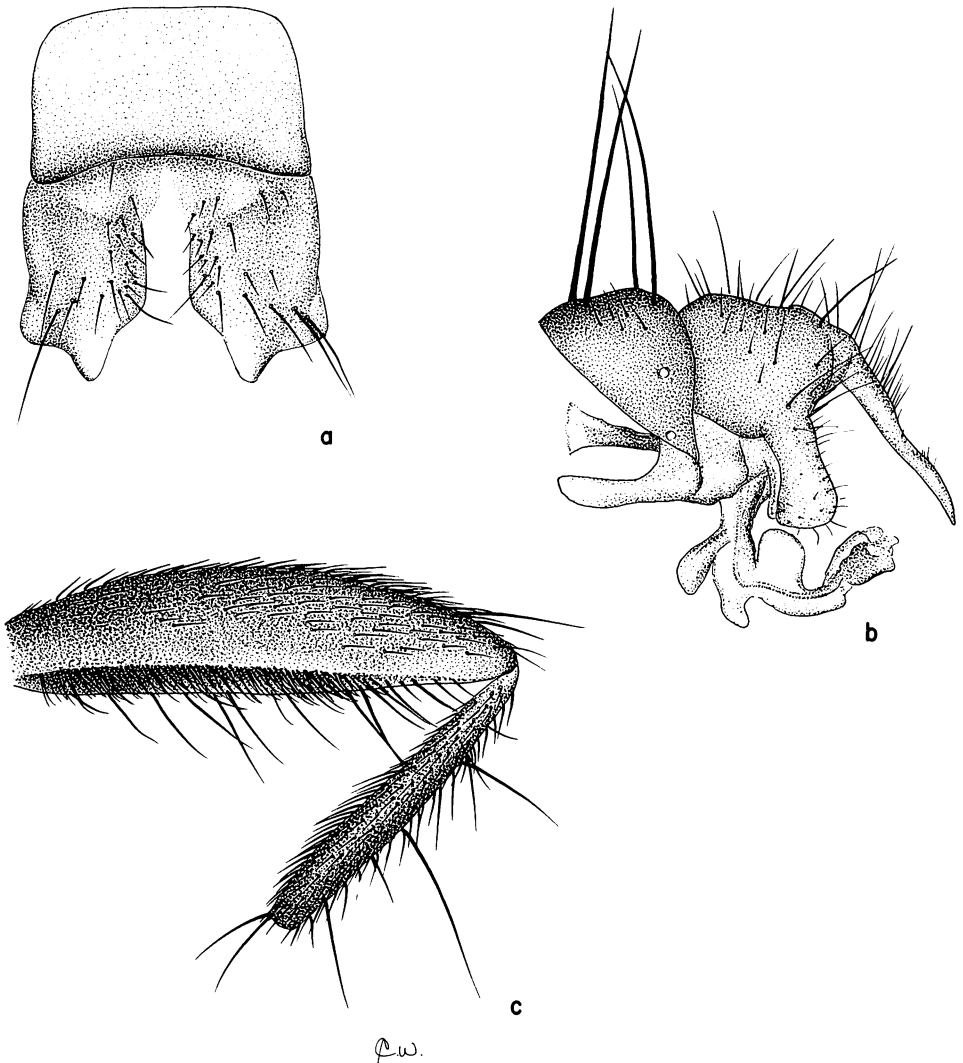


Figure 99—*Lispocephala planifemorata* n. sp.: a, fifth sternum of male; b, male genitalia, lateral; c, middle leg of male.

Type, allotype, and some paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of the U.S. National Museum, Canada Department of Agriculture, British Museum (Natural History), and the University of Hawaii.

***Lispocephala zonata* Hardy, new species (figs. 100a,b)**

Fitting the pallidibasis subgroup of species, closely resembling *hamifera*, but the males are readily differentiated by having the third antennal segment clear yellow and by lacking a dorsal hook-like process on the cercus; also mesonotum with three brown vittae, rather than two and the pale pollinosity of thorax and abdomen gray, rather than golden gray. The male palpi are brown basally, yellow to orange apically. The wings are distinctly brownish tinged, especially over anterior and apical portions. Otherwise fitting description of *hamifera* and with the fifth sternum and male genitalia as in figures 100a,b.

Length of body: male, 8.75 mm.

As noted under *hamifera*, the females are very close to that species and appear to differ in the coloration of the pale pollinosity on the thorax and ab-

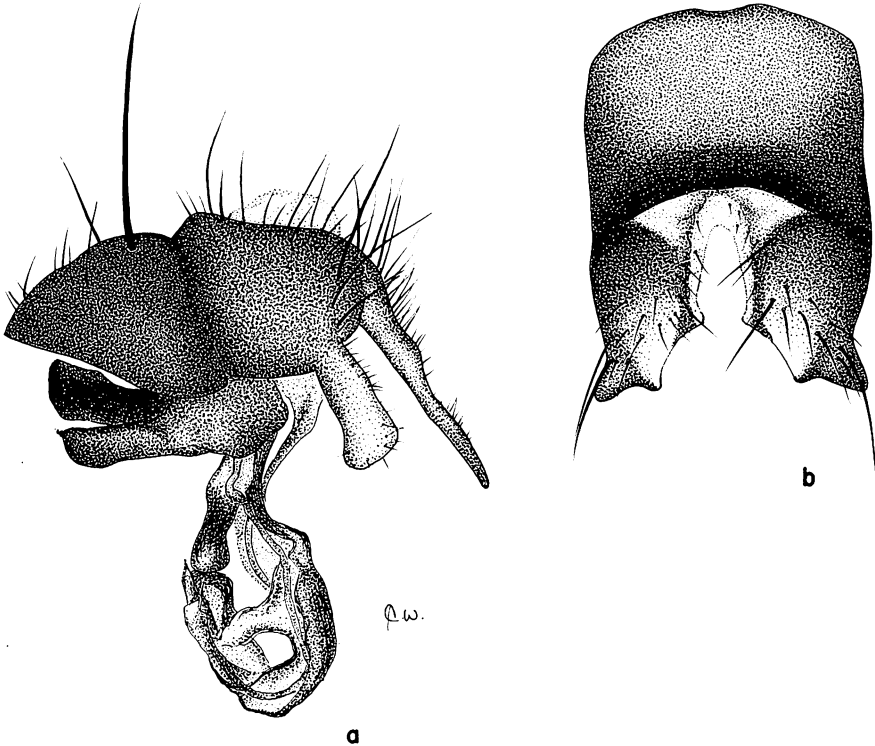


Figure 100—*Lispocephala zonata* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

domen, being gray rather than golden gray; also the wings are conspicuously brown tinged.

Length of body: female, 7.5–8.7 mm.

Holotype male and allotype female: Apee, E. Molokai, 1,700 ft., July 23–25, 1968 (K. Y. Kaneshiro). Four female paratypes from following localities on Molokai: Wailau Pass, 3,000 ft. elevation, December 1937 (F. X. Williams); same as type, September 1973 (F. do Val); and Waiakuilani Gulch, 3,000 ft., January 1973, reared ex *Dracaena* stem (S. L. Montgomery).

A series of female specimens from several localities over the island of Maui and one from Hualalai, Kona, Hawaii appear to belong here. I see no way to differentiate them from female specimens from Molokai. They have not been associated with males, however, and are not being designated as part of the type series.

DEXIOIDES SUBGROUP

Differentiated by having at least femora predominantly or entirely yellow; thorax typically gray pollinose; no sharp sexual dimorphism in coloring of the abdomen.

Lispocephala biseta (Grimshaw) (figs. 101a,b)

Coenosia biseta Grimshaw, 1901, Fauna Hawaiiensis 3(1):39.

Endemic. Hawaii (type-locality: Olaa). Type female in British Museum (Natural History).

Closely related to *dexioides* and fitting the general characteristics of that species, including the details of the terminal portion of the female abdomen (fig. 101a). Differing by having mesonotum nonvittate and abdominal terga 3–5 mostly gray pollinose with prominent paired black spots (fig. 101b). It also fits near *brachydexioides* n. sp. but differs by having the third antennal segment of female brown to black and the terminal segments of the abdomen more elongate (fig. 101a).

Length of body, 6.5–8.25 mm.

MALE. Unknown.

Eleven specimens are on hand from a number of localities over the island of Hawaii; some have been reared from rotting *Clermontia* bark and stems of *Charpentiera*, in association with native *Drosophila*. The male has not been associated.

Lispocephala brachydexioides Hardy, new species (figs. 102a–c)

In the pallidibasis group of species having a posterior bristle on front tibia, head narrow, and so on, and fitting in the dexioides subgroup because of the yellow legs and other characteristics. Resembling *biseta* (Grimshaw) but differing by having the antennae yellow in both sexes and the terminal segments of female abdomen differing in development as shown in figures 101a and 102a;

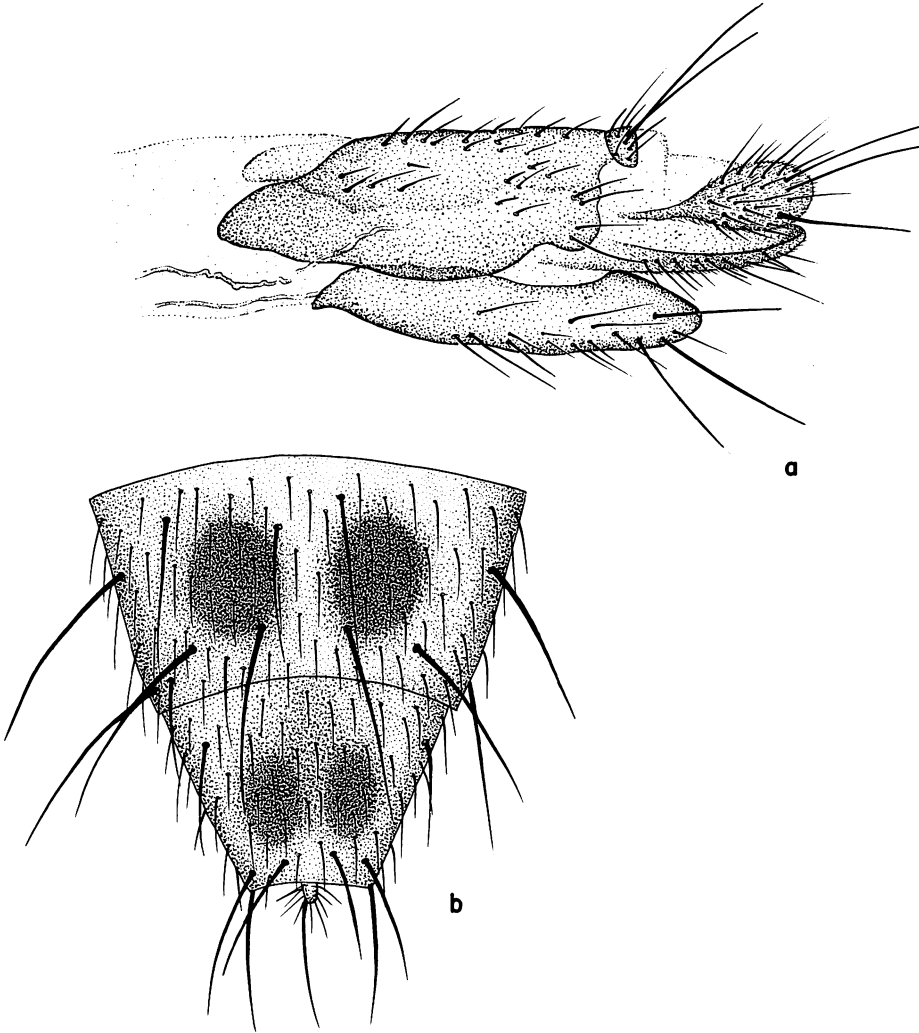


Figure 101—*Lispocephala biseta* (Grimshaw): a, female ovipositor, lateral; b, apical portion of female abdomen, dorsal.

also the narrow interfrontal area of *brachydexioides* (fig. 102b) will differentiate it from *biseta*.

MALE. Fitting most of the characteristics of *dexioides* and related species. *Head:* With interfrontal area rather strongly narrowed above, at level of lower superior fronto-orbitals, it is about as wide as the parafrontals (fig. 102b). Antennae entirely pale yellow. Aristae moderately plumose. *Thorax:* Entirely black in ground color, densely yellow-gray pollinose, especially over dorsum, the ground color completely obscured. *Legs:* Entirely yellow except for brown

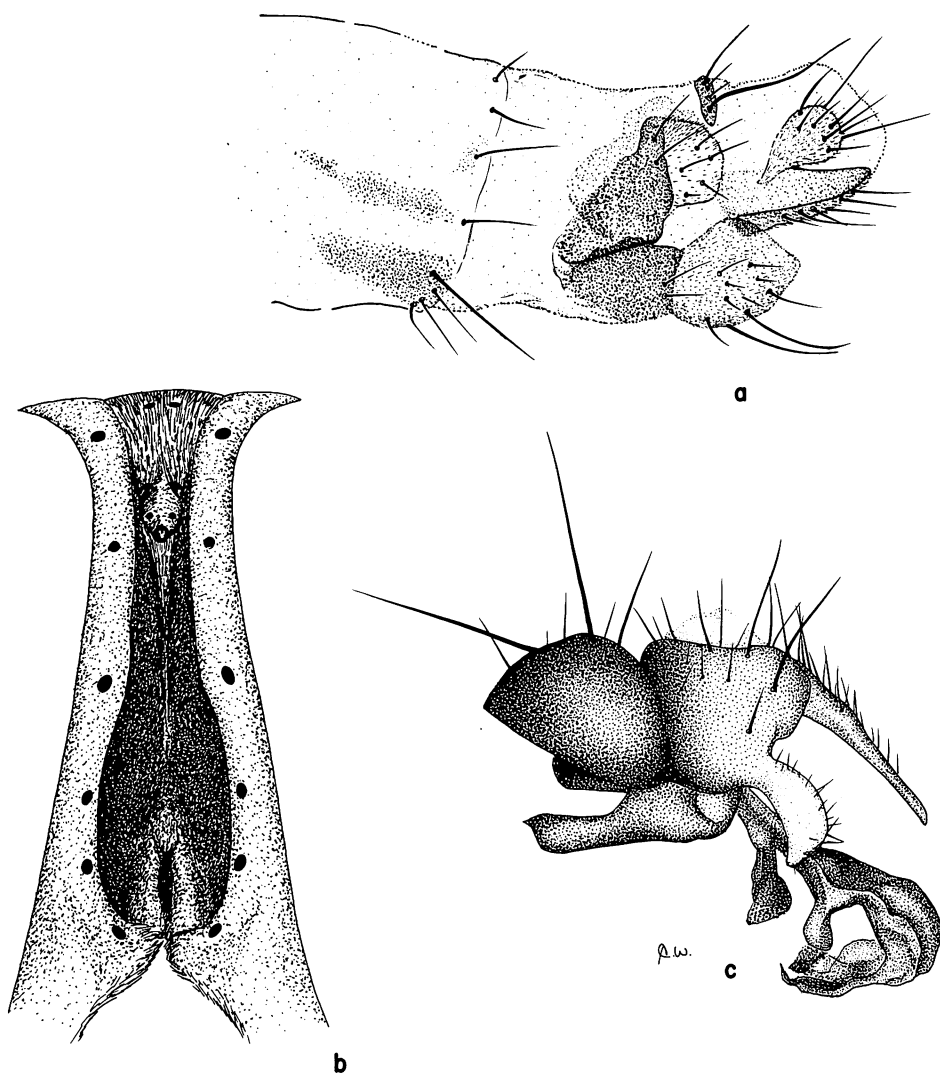


Figure 102—*Lispocephala brachydexioides* n. sp.: a, female ovipositor, lateral; b, front of head; c, male genitalia, lateral.

to black tarsi. Femora slender. Other details as in *dexioides*, the median posterior bristle of front tibia extends nearly three-fifths the distance to apex of segment. *Wings*: Hyaline, crossvein r-m situated just beyond middle of cell 1st M_2 . Calypters pale yellow-white. Densely yellow-gray pollinose. *Abdomen*: Basal three terga entirely yellow except for a brown longitudinal mark down middle of three. Remainder of terga broadly yellow on sides, dark brown to black over median portion of terga 4-6, and with prominent, large, subshining

black spots on terga 4 and 5; these are distinctly separated by yellow-gray pollen. Fifth sternum and genitalia entirely yellow. The former is very similar in shape to most species of this subgroup and the genitalia are similar to those of other species of this subgroup but appear to differ by having the surstyli pointed at apices (fig. 102c).

Length of body, 5.0–5.25 mm.

FEMALE. Fitting the characteristics of the male in most respects. Abdomen with subshining brown to black paired spots on terga 3–5 and the seventh tergum and sternum 7 + 8 short and broad as in figure 102a.

Length of body, 6.25–6.5 mm.

Holotype male: Bird Park, Kilauea, Hawaii, May 15, 1972 (D. E. Hardy). **Allotype female:** same locality as type, December 30, 1964 (D. Gubler). Nineteen paratypes, 17 females and 2 males, from the following localities on the island of Hawaii: same as type, March–August 1952–1972 (M. D. Delfinado, D. E. Hardy, W. B. Heed, W. C. Mitchell, D. T. Fujii, and S. L. Montgomery); Upper Olaa Forest, March–August 1952–1972 (D. E. Hardy and W. C. Mitchell); Keaa Forest, December 6, 1972 (M. D. Delfinado); Honokaa, July 1952 (W. C. Mitchell); Kipuka Ki, Kilauea, January 29, 1969 (M. D. Delfinado); Kilauea, 4,000 ft., reared ex *Sapindus*, July 17, 1969 (H. T. Spieth); Alaa Park, September 29, 1971 (M. D. Delfinado); forest above Paauiilo, 3,000 ft., June 19, 1964 (D. E. Hardy), and Kahaluu Forest Reserve, Hualalai, 3,000 ft., June 27, 1966 (J. W. Beardsley).

Type, allotype, and some paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala dexioides* (Grimshaw) (figs. 103a–c)**

Coenosia dexioides Grimshaw, 1901, Fauna Hawaiiensis 3(1):33.

Endemic. Hawaii (type-locality: Kona, 2,000 ft.). Syntypes, 2 males, 1 female in British Museum (Natural History).

A complex of species fit the general characteristics of *dexioides*, and Malloch's concept (1928:76) obviously pertained to two or more species. This complex has posteromedian bristles on the front and middle tibiae; legs mostly yellow; antennae of male yellow, third segment of female brown to black; the front legs not unusually elongate, the basitarsus about one-half as long as tibia, tarsomeres 1 + 2 about two-thirds as long as tibia, and the tibia and tarsus combined about equal in length to head, thorax, and first two abdominal segments; also abdominal terga, especially beyond the second, with broad black markings and no paired black spots. The hind femur has no preapical dorsal bristles. It is differentiated from related species by lacking paired black spots on the terga; having the mesonotum of female vittate; and hind femora brown at apices, especially in females. The genitalia are similar to other species of this subgroup. The surstyli are slightly bent downward apically; the parameres are strongly curved and the other genital characters are as in figure

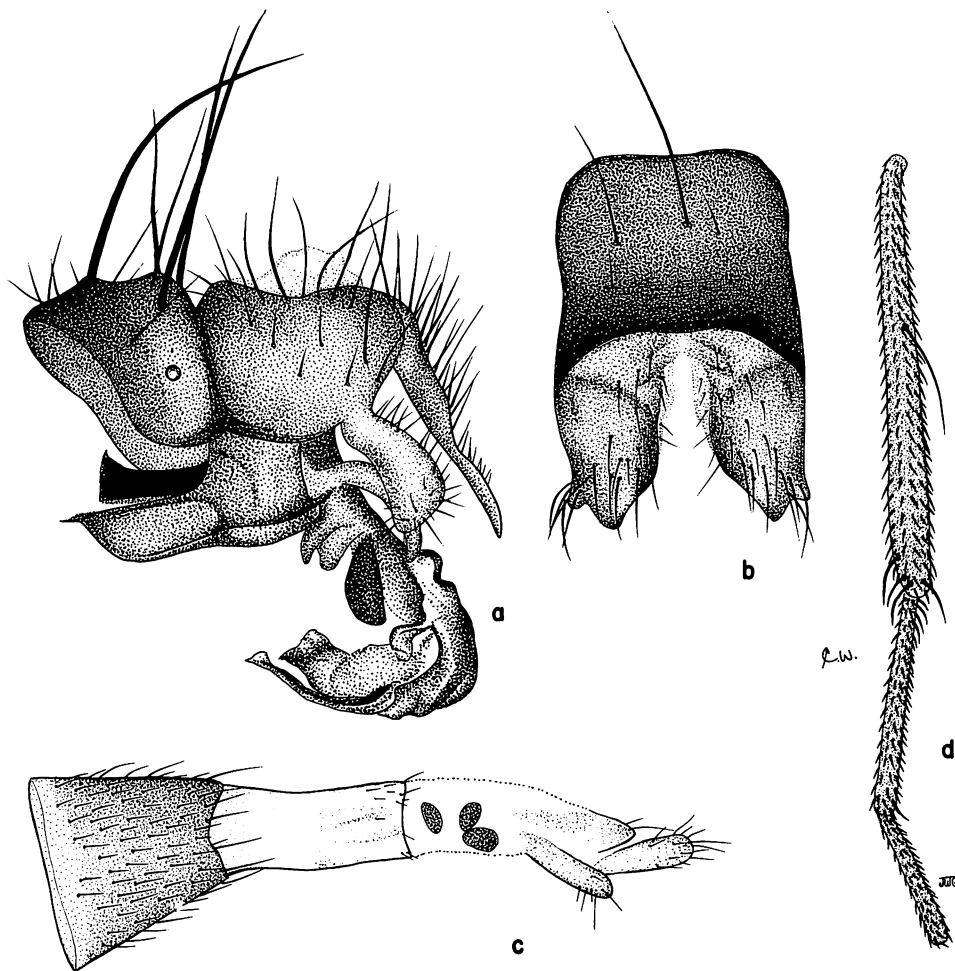


Figure 103—*Lispocephala dexioides* (Grimshaw): a, male genitalia, lateral; b, fifth sternum of male; c, apex of female abdomen, lateral; d, front tibia and two basal tarsomeres, lateral.

103a. The hind margins of the fifth sternum are undulated (fig. 103b). The posterior abdominal segments of the female are characteristic in development; the cerci, the seventh tergum, and the combined seventh and eighth sterna are each about three times longer than wide, as seen in lateral view (fig. 103c).

Orbits of front and face silvery gray, interfrontal area mostly opaque brown to black, the ocellar triangle gray, very narrow, inconspicuous, extending just beyond a level with lower superior fronto-orbital bristles. Arista moderately long plumose. The pollinosity of the female head is typically yellow-gray. Thorax rather densely gray to yellow-gray pollinose, with rather distinct, brown, longitudinal vittae on female and often with indistinct vittae on male.

Only one intraalar bristle. The posterior bristle of the front tibia is shorter, nearly straight in the male, extending approximately two-thirds the distance to apex of segment and in female extending approximately to apex of tibia. The ventral bristle on hind tibia is strong and curved in both sexes extending to apex of tibia. Calypters white, with a faint tinge of yellow, the upper about half as long as lower. Wings lightly fumose. I see nothing distinctive about the venation. First three terga mostly yellow in male, with hind margin of third rather broadly brown to black, and with a complete brown to black vitta down median portion. Remainder of abdomen black in ground color, densely gray pollinose on sides and along anterior margins, with a broad subshining black mark extending over apical two-thirds of terga 4 and 5, these marks are faintly brown dusted through the median portion but not distinctly divided. Female abdominal markings rather similar but typically yellow-gray pollinose.

Length of body, 7.0–8.0 mm.

This species is apparently restricted to the island of Hawaii and is most abundant on the western portion of the island, Kona District, on the slopes of Mauna Loa, Mount Hualalai, and the Kohala Mountains.

***Lispocephala difficilis* Hardy, new species (figs. 104a,b)**

Fitting in the pallidibasis group of species and in the subgroup with legs predominantly yellow, near *dexioides* (Grimshaw). The only characters which I see for differentiating it are that the postabdomen is densely gray pollinose with terga 4 and 5 each having a pair of well-defined black spots, readily visible in direct dorsal view and broadly separated by gray pollen; also that the front is entirely velvety black and the ocellar triangle is thinly pollinose, shining just below median ocellus and ending before the lower superior fronto-orbital bristles. Also, the arista is pubescent on basal portion rather than plumose as in *dexioides*. I see very little to differentiate these in the genitalia; however, the surstyli of *difficilis* are nearly three times wider at apex than at base, much more noticeably expanded, capitate (fig. 104a) than in *dexioides*. The markings of the female abdomen appear to be the same as in *dexioides*, and the only apparent difference seems to be in having the arista pubescent rather than plumose, front velvety black, and ocellar triangle short. The mesonotum in the male is densely gray pollinose with no indications of longitudinal vittae. In the female, three rather distinct, longitudinal, brown vittae are present. Otherwise fitting description of *dexioides*. Apex of hind femur broadly brown to black in both sexes and apices of mid and sometimes front femora brown to black in females. Fifth sternum of male as in figure 104b and male genitalia as in figure 104a.

Holotype male: Mount Tantalus, Oahu, 550 m., October 30, 1963, near bamboo forest (D. M. Tsuda). Allotype female: Mount Olympus, Oahu, 2,400 ft., August 16, 1936 (F. X. Williams). Sixteen paratypes, 2 males and 14 females, from same locality as allotype, July 8, 1918 (P. H. Timberlake) and the following localities on Oahu: Kaumuahona, November 17, 1918

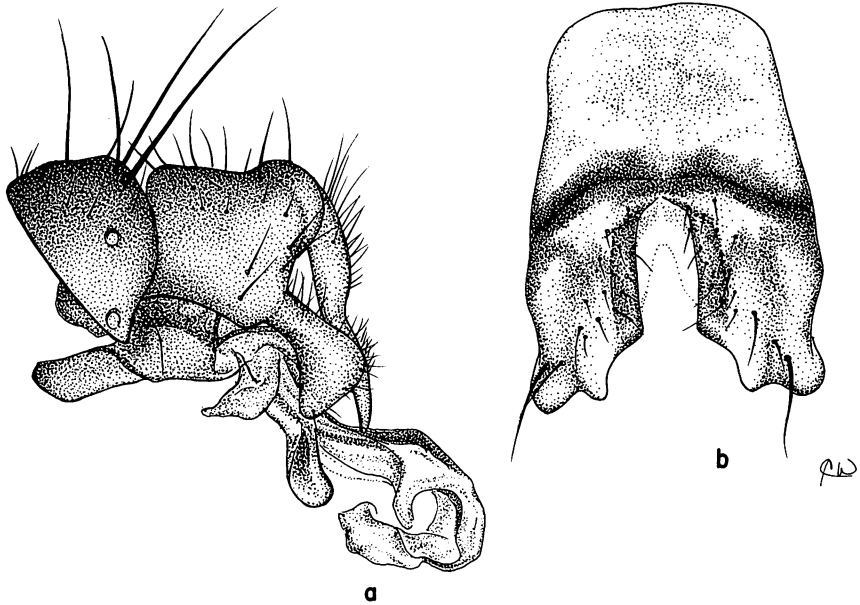


Figure 104—*Lispocephala difficilis* n. sp.: a, male genitalia, lateral; b, fifth sternum of male.

(reared ex rotting bark of *Cheirodendron*) (O. H. Swezey); Wiliwilinui, 2,200 ft., February 7, 1970 (reared ex rotting bark of *Cheirodendron*) (S. L. Montgomery); Kaala, 4,000 ft., May 20, 1970 (reared ex rotting bark of *Cheirodendron*) (S. L. Montgomery); hidden valley, near Kahana, May 31, 1970 (S. L. Montgomery); Kahana, August 31, 1924 (O. H. Swezey); Lanihuli, 2,000 ft., November 24, 1918 (O. H. Swezey); Niu, Kulepiamo Ridge, 2,000 ft., August 9, 1939 (E. H. Bryan, Jr.); Palikea, Waianae, 3,000 ft., November 15, 1936 (on foliage) (no collector given); Konahuanui, 2,600–3,000 ft., May 9, 1943 (E. C. Zimmerman); Puu Kahuaui, Koolau Mts., April 1952 (E. Dresner); Moanalua, 2,300 ft., August 1973 (S. L. Montgomery); and Poamoho, 2,100 ft., April 1973 (S. L. Montgomery).

Type, allotype, and some paratypes in B. P. Bishop Museum. Remainder of paratypes in collections of U.S. National Museum, Canada Department of Agriculture, Ottawa, and University of Hawaii.

***Lispocephala dilatata* Malloch (fig. 105)**

Lispocephala dilatata Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):74.

Endemic. Hawaii (type-locality: Pahala).

Known only from the type male in the B. P. Bishop Museum.

Fitting in the pallidibasis group and the dexioides subgroup in a small complex of species which have the front tarsi of male flattened dorsoventrally and differentiated by the development of the front tibiae and tarsi (fig. 105) and by



Figure 105—*Lispocephala dilatata* Malloch: front tarsus and apex of tibia.

having the femora blackened at apices. The front femora are blackened on apical two-thirds and the mid and hind are black at the extreme apices. The posteromedian bristle of the front tibia is long and curved, extending beyond apex of segment. Also, a strong posterior bristle is present at apex of tibia which extends beyond apex of basitarsus. The posterior and posteroventral surfaces of front tibia are densely covered with long, curved hairs over apical three-fifths of segment. Front basitarsus narrowed basally, broadly expanded apically, and with a row of strong, curved hairs extending down posteroventral surface. Second tarsomere strongly flattened and broad at its base, gradually tapered to a narrow apex (fig. 105), the remaining tarsomeres are normal in shape. Front tarsi predominantly orange, with a brown median vitta extending full length of basitarsus and with an opaque black median spot at base of

second tarsomere on the venter; on dorsal surface this area of the second tarsomere is white. The male genitalia have not been studied; *in situ*, I see nothing distinctive. In other details, fitting the general characteristics of the dexioides subgroup of species with antennae and palpi yellow, thorax densely gray pollinose, basal three abdominal segments largely yellow, and terga 4-6 gray pollinose with a large, opaque brown median spot dorsally.

Length of body, 8.5 mm.

***Lispocephala flaccida* Hardy, new species (fig. 106)**

Fitting the description of *longipes* in all details except that the male aedeagus is weakly sclerotized, mostly hyaline, and very different in development, appearing rather globose, not strongly convoluted apically (fig. 106). I see no other characteristics which will differentiate this species.

The first four abdominal segments are pale yellow except for a faint tinge of brown on median portion of one-two, a dark brown mark over middle of three-four, and posterior portion of four dark brown. Genitalia as in figure 106. The straight hairs on the underside of the femur are very conspicuous, about two times longer than the setae down sides.

Length of body, 7.0 mm.

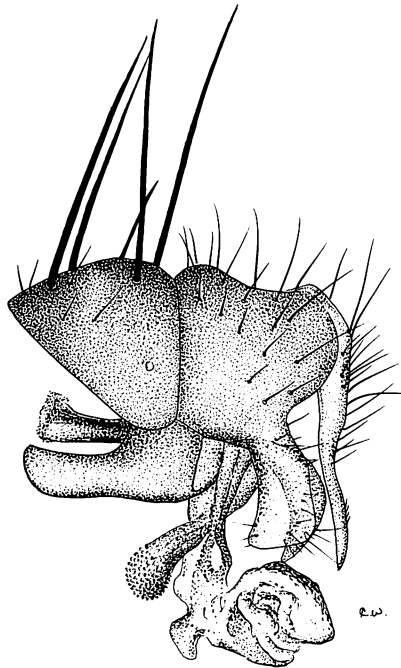


Figure 106—*Lispocephala flaccida* n. sp.: male genitalia, lateral.

Holotype male: Waikamoi, Maui, May 31, 1966, reared from *Cheirodendron* leaves (W. B. Heed). One male paratype same locality, August 1958, 4,000 ft. (D. E. Hardy).

***Lispocephala hirtifemur* Malloch (figs. 107a-d)**

Lispocephala hirtifemur Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):77.

Endemic. Kauai (type-locality: Kaholuamano). Type male in B. P. Bishop Museum.

Fitting in the pallidibasis group of species in the dexioides subgroup and readily differentiated from all other known Hawaiian species by having the palpi of both sexes capitate (fig. 107b) and the hind femur of the male with

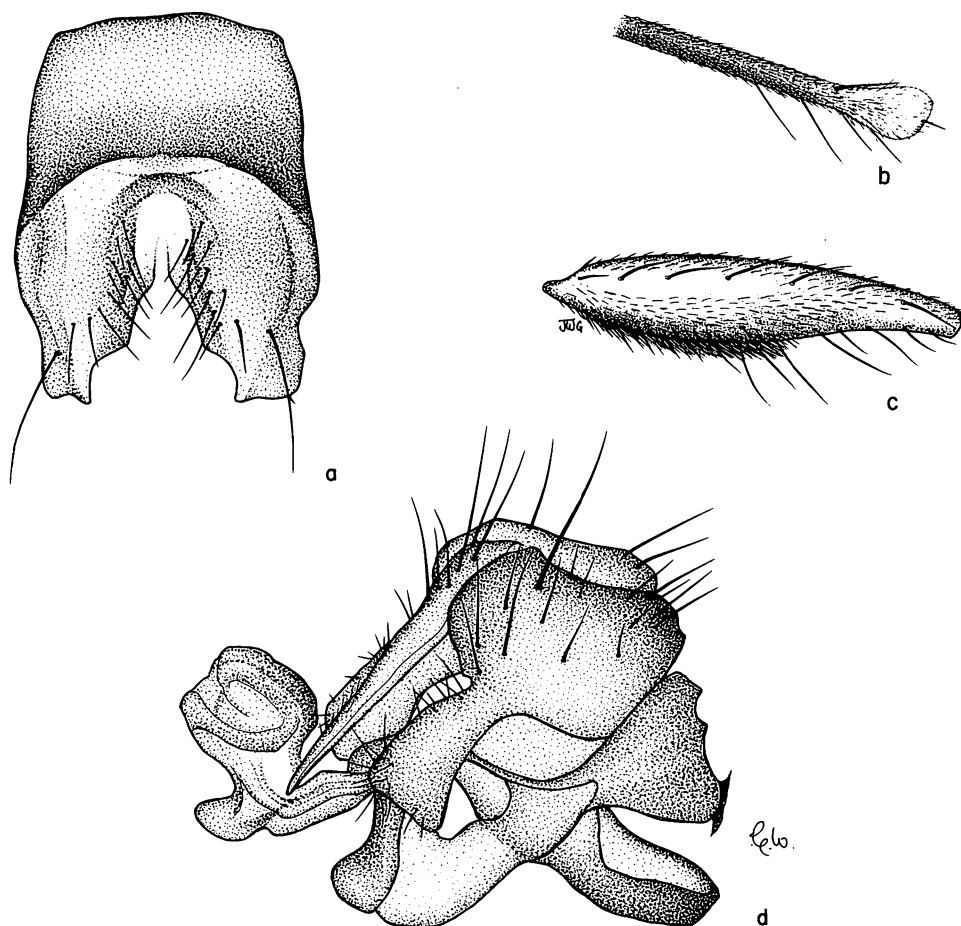


Figure 107—*Lispocephala hirtifemur* Malloch: a, fifth sternum of male; b, palpus; c, hind femur of male, posterior; d, male genitalia, lateral.

dense, fine, black hair over ventral surface on basal three-fifths of segment (fig. 107c).

Antennae of male entirely pale yellow; in female, with third segment brown to black. Palpi of male with dark-colored stems and yellow-white over the capitate apices, palpi entirely black in the female. Head approximately as high as wide and with front rather narrow, about two times longer than wide and about one-half as wide as compound eye. Malloch's type was greased and the pollinosity of the head and body is not correctly described in the original. In the male, the frontal orbits and face are densely silvery pollinose (pubescent). In the female, the frontal orbits are yellow to brownish pollinose and the upper facial orbits are slightly yellowish. The male thorax is densely gray pollinose, with a slightly yellowish cast, the ground color is completely obscured and no dark markings are present. In the female the median portion of the mesonotum is broadly brown pollinose, slightly subshining, through the area roughly outlined by the dorsocentral bristles. Femora mostly yellow, apices of hind brown in male and apices of mid and hind brown in female. Hind femur of male as in figure 107c. First three abdominal segments of male predominantly yellow, with a discoloration of brown down median portion, and apical portion of abdomen predominantly dark brown. Female abdomen mostly brown to black, yellow on sides of first two and base of third terga and narrowly gray on apices of terga 2-4. Only one intraalar bristle and calypters white, with a faint tinge of yellow on the margins; the upper is about half as long as lower. Male fifth sternum as in figure 107a and genitalia as in figure 107d. Other details as given in the original description.

Length: body, 6.5-7.0 mm.; wings, 6.5-6.75 mm.

I have seen a number of specimens from several localities in the Kokee-Alakai Swamp region of Kauai, some have been reared from rotting stems or bark of *Cyanea* and *Cheirodendron*, breeding in association with native *Drosophila*.

***Lispocephala latimana* (Grimshaw) (figs. 108a-c)**

Coenosia latimana Grimshaw, 1901, Fauna Hawaïensis 3(1):35, pl. II, fig. 20.

Endemic. Lanai (type-locality: "Mts. Koele, over 2000 feet."—obviously Lanaihale).

Type male in British Museum (Natural History).

Fitting in the pallidibasis group, in the dexioides subgroup, and in the species complex characterized by having the front tarsi of males flattened dorsoventrally, as wide or wider than front tibiae. It fits near *latitarsis* n. sp., from Oahu, but differs by having the femora all yellow; front tibia with rather dense, short, fine hairs ventrally; front basitarsus less than half as long as tibia (fig. 108b); also third tergum of abdomen with a large, triangular, black mark in middle.

Fitting the general characteristics of the entire group, that is, head about as

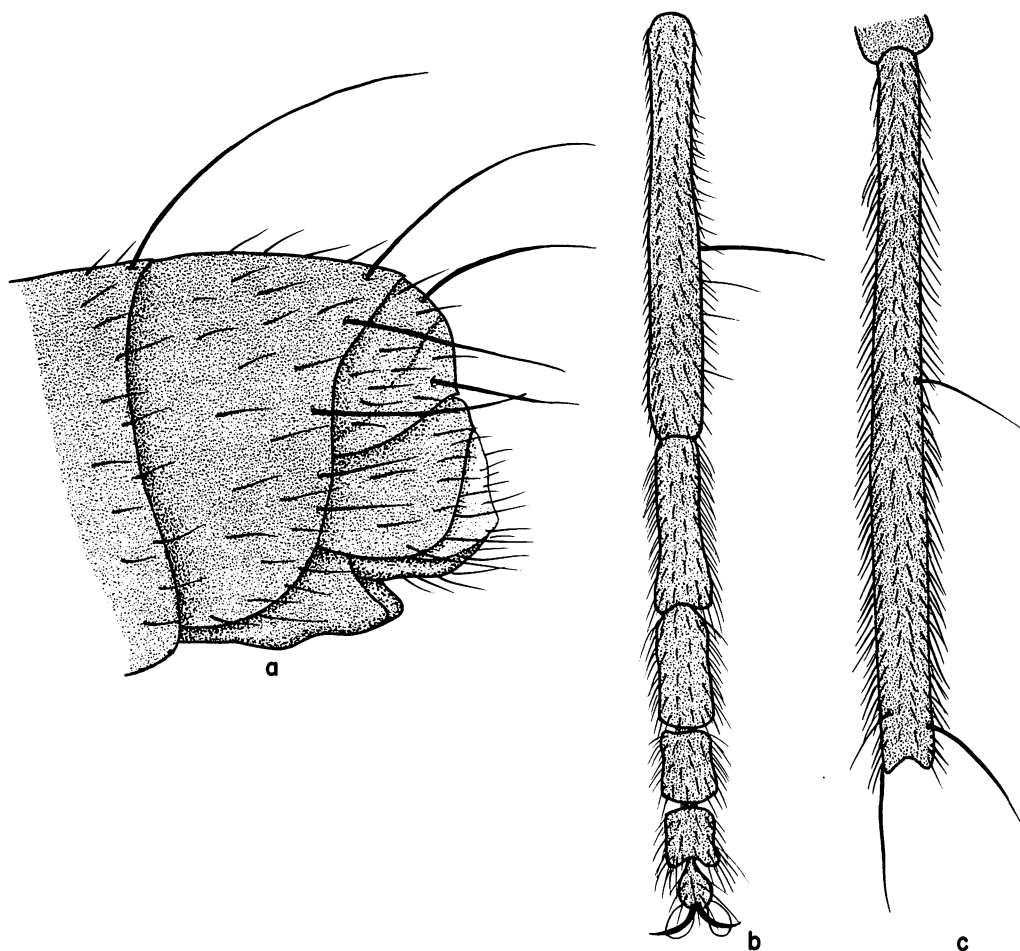


Figure 108—*Lispocephala latimana* (Grimshaw): a, apex of type male abdomen, *in situ*; b, front tibia and tarsus, type male, dorsal; c, mid tibia, type male, dorsal.

high as wide, antennae and palpi of male all yellow, and legs predominantly yellow. The following additional notes are based upon the type. The palpi are densely yellow pilose and have a row of thin bristle-like hairs along anteroventral surface and about two short black bristles at apex. Legs yellow with a faint discoloration of brown on upper apical portion of hind femur and with last two-three tarsomeres brown. The posterior bristle of front tibia is straight, extending about three-fifths the distance to apex of segment. The tarsi are rather strongly flattened and approximately equal in width to tibia (fig. 108b). Basitarsus less than half as long as tibia and with a clump of strong, curled hairs on ventral surface near base. All tarsomeres, except the apical one, with a short, thick, posterior bristle at the apex. Posterior bristle of middle tibia

short and straight, extending one-third to one-fourth the distance to apex of segment (fig. 108c). Thorax dark brown to black in ground color, densely yellow-gray pollinose, with no evidence of brown markings on the dorsum. Wings rather faintly fumose. Last section of vein $M_1 + 2$ about one-half longer than preceeding section, the proportions are 52 : 30. Crossvein r-m situated just beyond middle of cell 1st M_2 , nearly at apical three-fifths of the cell. Abdomen with first and second segment entirely yellow and the third predominantly so with just a small, round, basomedian spot. Fourth tergum broadly yellow on the sides and at base, with a large, triangular-shaped, dark brown to black spot covering median portion; the brown spot is densely yellow pollinose. Fifth tergum dark brown to black in ground color, yellow on margins and densely yellow pollinose. The genitalia are predominantly yellow to rufous, the visible structures are as in figure 108a.

Length of body, 7.0 mm.

Known only from the type male.

***Lispocephala latitarsis* Hardy, new species (figs. 109a-c)**

Fitting in the pallidibasis group near *latimana* (Grimshaw), from Lanai, and differing by having the hind femora broadly blackened at apices, front basitarsus slightly over one-half as long as the tibia; posterior bristle of front tibia extending to about apex of segment; posterior bristle of middle tibia extending over half the distance to apex and third tergum with a large, triangular, black mark in middle. In *latimana* the legs are entirely yellow; front basitarsus distinctly less than half as long as tibia (fig. 108b); posterior bristle of front tibia shorter, extending approximately three-fourths the distance to apex; posterior bristle of middle tibia extending about one-third the distance to apex of segment and first three terga of abdomen entirely yellow.

MALE. Fitting most of the characteristics of *latimana*. Most of the additional characters noted here probably also pertain to that species; however, the genitalia of *latimana* have not been studied. Frontal triangle very short, ending slightly before a level with the lower superior fronto-orbital bristles. Interfrontal area opaque reddish brown. Aristae long pubescent on basal two-fifths to one-half. Only one intraalar bristle on mesonotum. Acrostichals in two irregular rows. Calypters clear white. *Legs*: As noted above. Hind tarsi entirely black. Third to fifth tarsomeres of middle legs black and third to fifth tarsomeres of front legs black dorsally. All tarsomeres of front legs yellow ventrally with an opaque, black spot at base (fig. 109b). First tarsomere with three long, curved, posteroventral hairs at base and with the anteroventral portion densely black setose over about basal half. Each tarsomere with short, thick, black, anteroventral and posteroventral bristles at apex. Front tibia with numerous erect, black, ventral hairs on the apical half of segment. Preapical dorsal bristle of front tibia extending almost as long as the front basitarsus. *Thorax*: Mesonotum with three rather indistinct, brown vittae. *Abdomen*: Fifth sternum of male as in figure 109c. A pair of very strong basal bristles are present on

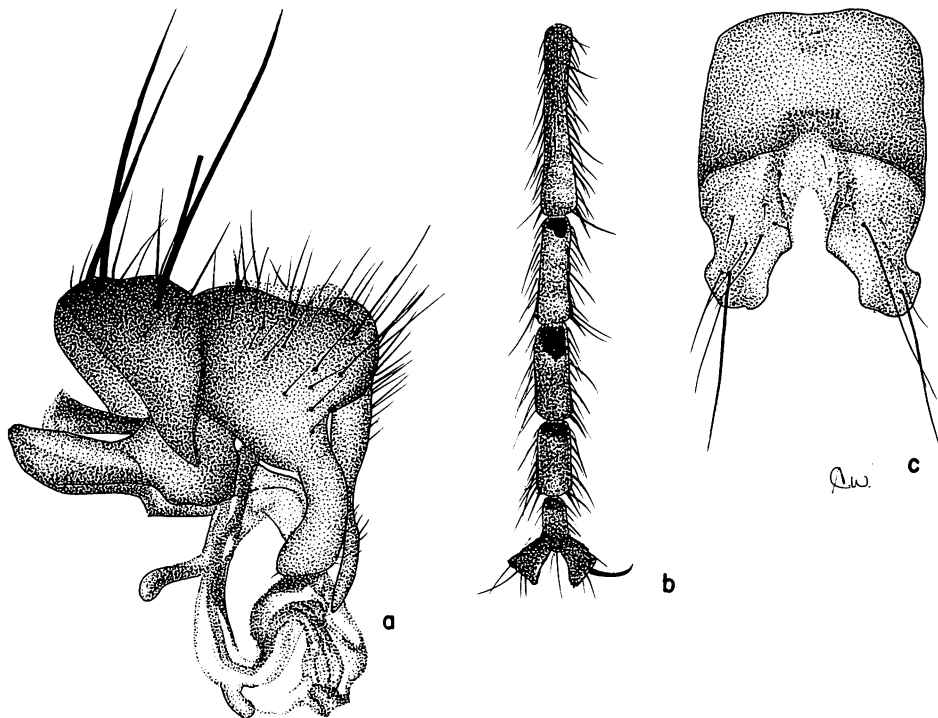


Figure 109—*Lispocephala latitarsis* n. sp.: a, male genitalia, lateral; b, front tarsus of male, ventral; c, fifth sternum of male.

fifth sternum, these extend nearly two times the length of the sclerite. Male genitalia very similar in development to *dexioides* and related species (fig. 109a).

Length of body, 6.25–7.0 mm.

FEMALE. Fitting description of male in most respects but with median portion of mesonotum, area between dorsocentral rows, brown, rather thinly gray pollinose. Third antennal segment brown in ground color except for the basal portion; mid and hind femora broadly tinged with brown on apical portions and abdominal terga 3–5 each with a large, subshining, median, brown spot which is narrowly and indistinctly divided by a line of gray pollen down the middle.

Holotype male: Waialae Nui Ridge, 1,800 ft., Oahu, October 24, 1971, reared ex rotten bark *Dracaena* (S. L. Montgomery). Allotype female: Puu Kaua, Oahu, 2,200 ft., August 4, 1970. Reared ex *Pisonia* stem (S. L. Montgomery). Six paratypes, two females and four males, from the following localities on Oahu: same data as allotype except October 10, 1971; Puupane, Oahu, 1,800–2,000 ft., February 20, 1970 and September 7, 1970, reared ex rotting *Dracaena* stem and ex *Cyanea* bark (S. L. Montgomery); Wiliwilinui,

Oahu, October 1, 1970, 2,000 ft., reared ex rotting *Cheirodendron* (S. L. Montgomery) and East Makaleha Valley, Oahu, July 21-27, 1970, reared ex *Tetraplasandra* bark (S. L. Montgomery).

Type, allotype, and one paratype in B. P. Bishop Museum. Other paratypes in collections of U.S. National Museum and the University of Hawaii.

***Lispocephala longipes* (Grimshaw) (figs. 110a-d)**

Coenosia longipes Grimshaw, 1901, Fauna Hawaïensis 3(1):38.

Lispocephala orbitalis Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):78. **New synonym.**

Endemic. Hawaii (type-locality of *longipes*: Kilauea, and of *orbitalis*: Glenwood), Maui, Molokai, and Lanai.

Biology. Lives in close association with native Drosophilidae. Specimens have been reared from decaying *Cheirodendron* leaves.

Fitting the pallidibasis group of species in the dexioides subgroup with the legs mostly yellow. Fitting nearest to *seminitida* Malloch and differentiated by having the eye orbits entirely gray pollinose and the third abdominal tergum entirely yellow on sides. The synonymy of *orbitalis* is based upon comparison of the type male with a long series of specimens from Kilauea and other localities on the island of Hawaii. Malloch differentiated *orbitalis* by having the ventral bristles of hind tibia short and straight while *longipes* was keyed as having hind tibia with a long, curved, ventral bristle which extends to or almost to apex of tibia. This is a sexual character, *longipes* was based upon the female and *orbitalis* upon the male. I find some variation in the development of the ventral bristle on the hind tibia on the male. On most it is straight, rather short, extending approximately two-thirds the distance to apex of segment. In other specimens the bristle is slightly curved and extends approximately three-fourths the distance to apex.

The *longipes* complex of species is characterized by the elongate front tarsi, with the basitarsus distinctly over half as long as tibia (fig. 110c), and first two tarsomeres about equal in length to tibia; tibiae and tarsi combined, nearly as long as entire body, in both sexes extending about as far as apex of third abdominal segment. Median portion of mesonotum mostly shining brown to black in females and with three rather distinct, longitudinal vittae in both sexes. Sides of first three abdominal terga broadly yellow with a median brown to black longitudinal vitta in male, and sides of first two and anterolateral portions of third yellow in females. Besides *longipes* the complex apparently includes *flaccida* n. sp. from Maui and *seminitida* Malloch from Oahu. It is possible that the populations of "*longipes*" from Maui, Molokai, and Lanai may prove to be a distinct species but at present no characters can be found for differentiating them.

The sexual dimorphism in this complex is displayed by the more extensively yellowed, basal portion of the male abdomen, the all yellow antennae of the male, shorter posterior bristles on front tibiae and short, straight, ventral

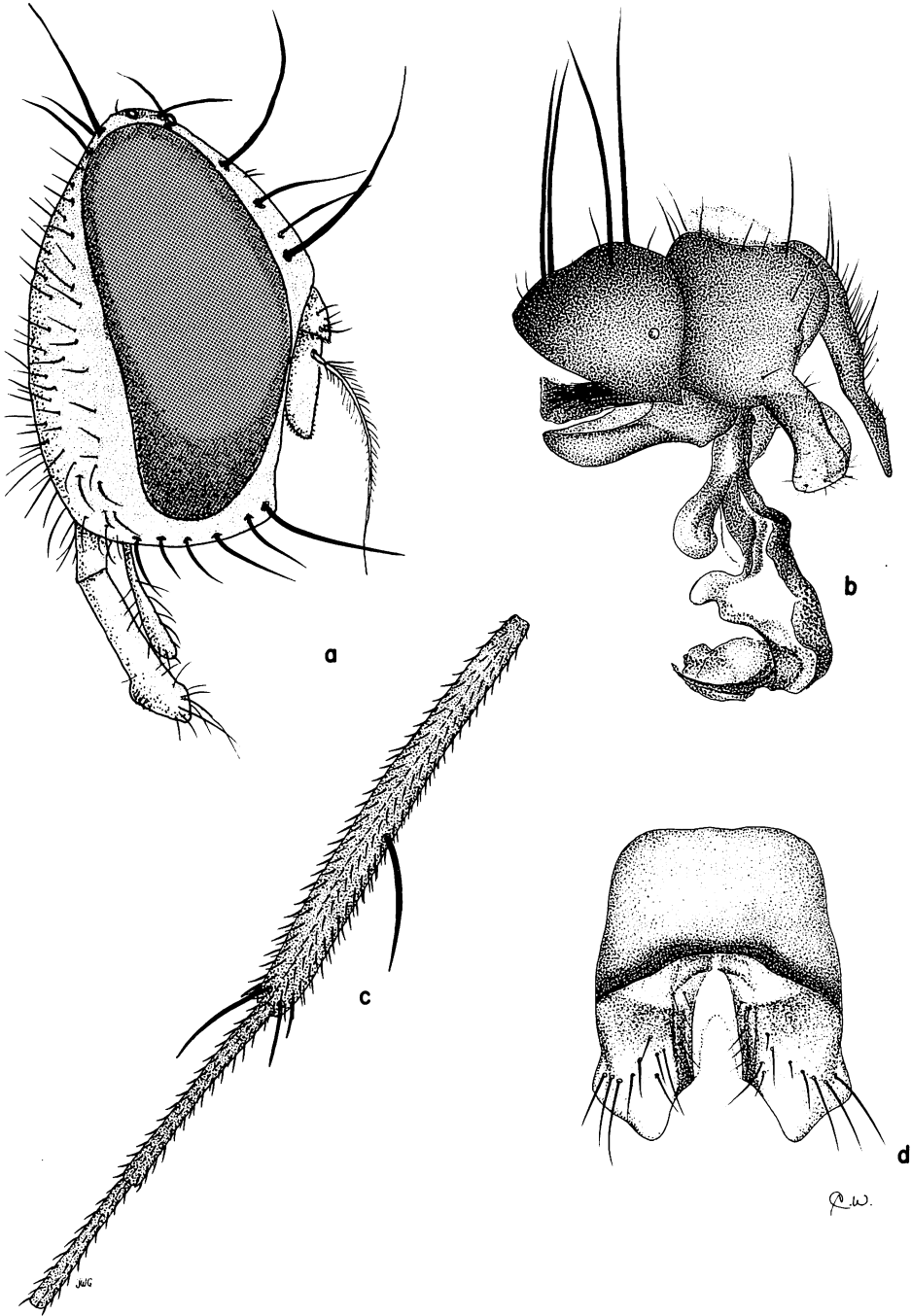


Figure 110—*Lispocephala longipes* (Grimshaw): a, head, lateral; b, male genitalia, lateral; c, front tibia and two basal tarsomeres of male, dorsal; d, fifth sternum of male.

bristles on hind tibiae of male; mesonotum of male predominantly gray with three rather faint, subshining, median vittae and male wings rather lightly fumose, whereas in the female the anterior and apical portions of the wing are brown to blackish.

L. longipes is differentiated from *seminitida* by the all pollinose orbits in the male and from *flaccida* n. sp. by having the aedeagus rather heavily sclerotized, dark brown, well developed, and strongly convoluted apically (fig. 110b), rather than weakly sclerotized, almost colorless and different in development (fig. 106a).

Head as in figure 110a. Tarsi entirely dark brown to black. Broad apices of mid and hind femora brown to black in females, the apical halves are blackened, also the apices of front femora are tinged with brown to black in the female. Hind femora of male with numerous erect ventral hairs. Fifth sternum of male broad, almost truncate as seen in lateral view. The ventral view is as in figure 110d. Wings smoky, more intensely infuscated in the females, verging into brown or blackish on apical 2/3 especially in specimens from Maui and Molokai.

Length of body, 7.0–9.0 mm.

One male specimen on hand from Haipuaena, Maui, June 29, 1920 (C. N. Forbes) is apparently an aberrant *longipes*. It would seem to be a new species differentiated by having the anteroventral bristle of hind tibia long and curved rather than straight, extending about to apex of segment, and extending 2/3 the distance to apex, wings dark brown over apical 3/5, and arista long plumose. The genitalia are identical with those of typical *longipes*.

***Lispocephala pollinosa* Malloch (figs. 111a,b)**

Lispocephala pollinosa Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):76.

Endemic. Maui (type-locality: Wailua). Type male in B. P. Bishop Museum.

Fitting in the pallidibasis group and in the dexioides subgroup by having the legs mostly yellow, front tarsi not elongated, and other details. It appears to differ from all other known species by having the abdomen entirely yellow, with only faint indications of pale, brown spots visible on terga 4 and 5 under strong light. Based upon the type male and the two female specimens in Malloch's original series, it is obviously very close to, and may be synonymous with what I consider to be *valida* (Grimshaw). The latter is characterized by having paired, brown to black spots on the abdominal terga. No specimens have been seen which compare exactly with the type, although in a series of female specimens on hand there appears to be considerable variation in the markings on the abdomen from those specimens which, from direct dorsal view, appear to have the abdomen entirely yellow, but upon examination in end view, have faint to distinct, paired brown spots on terga 3–5 and verging into those specimens which have clearly defined, brown to black markings on the terga. In all the male specimens which seem to associate with these females,

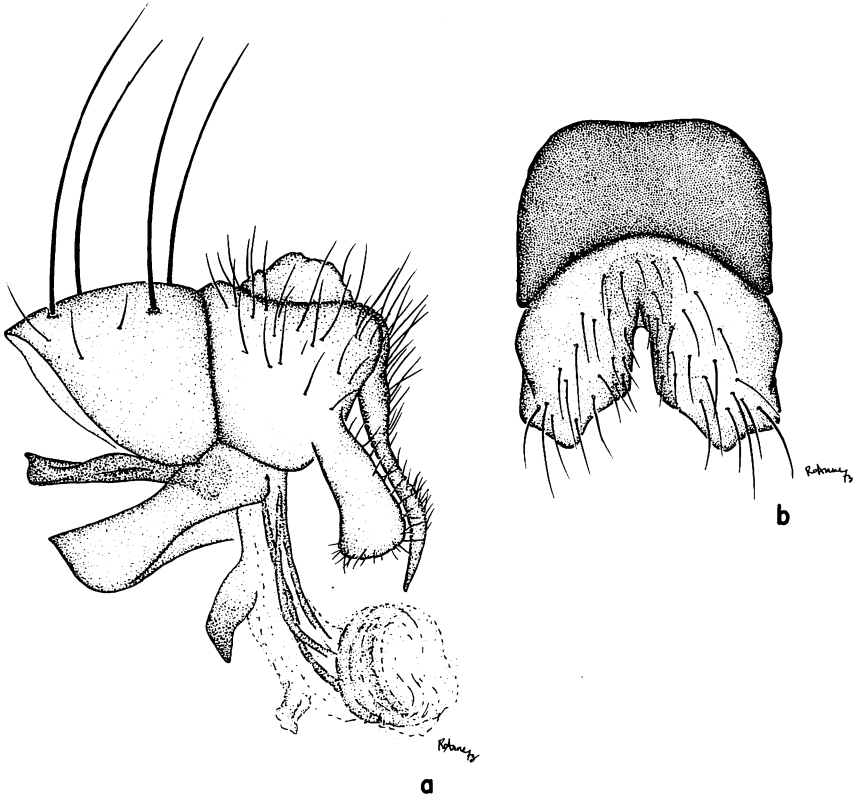


Figure 111—*Lispocephala pollinosa* Malloch: a, male genitalia, lateral; b, fifth sternum of male.

the abdominal markings are very distinct, black in ground color. Additional specimens will need to be studied to clarify the reliability of the abdominal markings. Based upon the type, the male genitalia seem to differ by the aedeagus being not so heavily sclerotized as in *valida* and the apical portion different in development as shown in figures 111a and 113b. Another distinctive feature may be the dense covering of golden yellow pollen over the thorax and abdomen (as seen in strong light) and the fact that the sides of the mesonotum, humeri, scutellum, and most of the pleura are yellow in ground color. Some of the specimens on hand which I consider to be *valida* would also fit the above. The thorax is densely golden yellow pollinose and some individuals have the yellow markings as in typical *pollinosa*. As I have indicated, it is probable that these characters may integrate.

The following descriptive notes are made from the type male.

The pollinosity of the head, thorax, and abdomen is golden yellow (viewed in strong light) and completely obscures the ground color. Interfrontal area mostly rufous, tinged with brown, verging into brown or black on upper por-

tion. Measured opposite the lower superior fronto-orbitals, the interfrontal area is approximately two times wider than the parafrontalia. The ocellar triangle extends as a long, thin point to about opposite the upper inferior fronto-orbital. Antennae and palpi entirely yellow, aristae moderately long plumose. As seen when wet with 70 percent alcohol, the thorax is entirely yellow in ground color except for a broad, brown to blackish mark covering all of the dorsomedian portion of mesonotum and a brown tinge on lower sternopleuron. Calypters pale yellow. Legs entirely rufous except for the brown to blackish tarsi. Femora slender. Bristles as in other species of the dextioides subgroup except that the median posterior of front tibia extends approximately to apex of segment. Abdomen completely yellow except for a faint tinge of brown on sides of terga 4-5. Fifth sternum longer than wide, shaped as in figure 111b with a narrow V-shaped cleft on hind margin. Genitalia as in figure 111a.

Length of body, 7.0 mm.

It should be noted that in the original description Malloch gave the body length as 8.0-9.0 mm.

***Lispocephala seminitida* Malloch**

Lispocephala seminitida Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):78.

Endemic. Oahu (type-locality: Wailupe Ridge).

This species seems to fit the characteristics of *longipes* (Grimshaw) except that the type male has the upper eye orbits polished black in the area from the lower superior fronto-orbital bristles to the vertical bristle. I have not seen further male specimens and cannot confirm the reliability of the polished area on the orbits. Also on the type, the third abdominal terga is entirely black except for the extreme lateral margins and a narrow border along sides of posterior margin. The only two female specimens of the *longipes* complex which have been seen from the island of Oahu appear to differ by having the wings subhyaline rather than dark brown to blackish over anterior and apical portions.

Further material from Oahu needs to be studied.

Length of body, 6.5 mm.

***Lispocephala univittata* Hardy, new species (figs. 112a-c)**

Belonging in the dextioides complex and fitting nearest to *brachydextioides* n. sp.; because of the development of the terminal segment of the female abdomen and the all yellow antennae in both sexes, the two are much alike. It is readily differentiated from all other known *Lispocephala* of the pallidibasis group of species by having the thorax entirely yellow to rufous, except for a dark brown to black vitta extending down the median portion of the mesonotum, or with sides of mesonotum broadly yellow and scutellum yellow.

MALE. Fitting the characteristics of *dextioides* in most respects. Head: Orbits of front and face golden gray on type; also, face of type gray, tinged faintly with

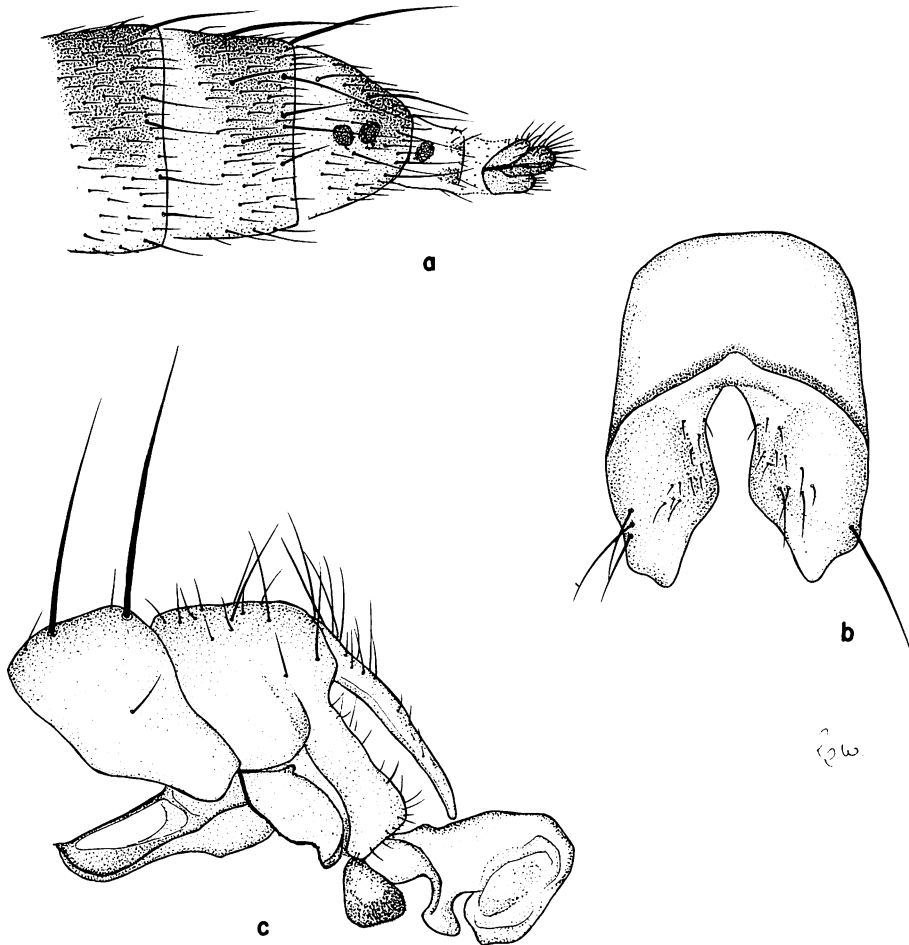


Figure 112—*Lispocephala univittata* n. sp.: a, apical portion of female abdomen, lateral; b, fifth sternum of male; c, male genitalia, lateral.

yellow. On a paratype male, the orbits and face are more distinctly gray pollinose. Frontal triangle ending slightly before a level with the lower superior fronto-orbital bristles. *Thorax*: Pleura with a tiny spot of black on the subalare sclerite. In the type, the median black vitta down the mesonotum is narrowed through the middle area of suture and expanded on posterior portion. In other specimens, it occupies the region between dorsocentral rows. Thorax completely covered with yellow pollen. Only one intraalar bristle. Calypters pale yellow, the upper less than half as long as the lower. *Legs*: Yellow except for brown to black tarsi and except for a faint tinge of brown on apices of hind femora. The front tarsi are more slender than is typical for the dextioides complex, the basitarsus is about three-fifths as long as the tibia, and the first two

tarsomeres combined are about five-sixths as long as the tibia. Entire tarsus is about equal in length to the head plus the thorax. The posterior bristle on front tibia is only slightly curved and extends nearly two-thirds the distance to apex of segment. The posteroventral bristle on hind tibia is gently curved and extends approximately as far as the apex of segment. *Abdomen*: Mostly yellow, fourth and fifth terga with a large dark brown to black spot over apical median portion, these are very faintly divided by brown pollen through the median portions. Male fifth sternum as in figure 112b and genitalia as in figure 112c, the surstyli are slightly pointed apicoventrally and the parameres are greatly enlarged at apices.

Length of body, 6.5 mm.

FEMALE. Fitting description of male in most respects. The posterior bristle of front tibia is elongate, extending well beyond apex of segment and the ventral bristle of hind tibia long and curved. The female abdomen has a brown to black marking extending down median portion of terga 1-2 and a large spot over the median portion of 3, 4, and 5; this area is dark brown pollinose and only very faintly divided down median portion. The markings on the first three terga vary considerably, in some specimens the first two terga are entirely yellow and the third is only tinged with brown over the median portion. Ovipositor and terminal segments of abdomen as in figure 112a.

Holotype male: Logging road, Laupahoehoe Sec., Hawaii, 3,000 ft., October 3, 1969 (D. E. Hardy). Allotype female: Honaunau Forest Res., Hawaii, January 31, 1967 (K. Y. Kaneshiro). Twelve paratypes, nine females and three males, from the following localities on Hawaii: same as type and allotype (F. Yamasato and K. Y. Kaneshiro); Olaa Forest Res., September 20-29, 1968-1972 (J. M. Tenorio and D. Fujii); Kipuka Ki, Kilauea, December 21, 1966 (K. Y. Kaneshiro); near Pawaina, Kona, 3,000 ft., July 13, 1965 (D. E. Hardy); Keaau Dist., 2,200 ft., January 15, 1973 (H. L. Carson); and Bishop Trust road, Hualalai, 2,200 ft., July 14, 1965 (D. E. Hardy).

Type, allotype, and some paratypes in B. P. Bishop Museum. Other paratypes in collections of the U.S. National Museum, British Museum (Natural History), and the University of Hawaii.

***Lispocephala valida* (Grimshaw) (figs. 113a-c)**

Coenosia valida Grimshaw, 1901, Fauna Hawaiiensis 3(1):34.

Endemic. Maui (type-locality: Haleakala, 5,000 ft.) and Molokai. Type female in British Museum (Natural History).

This species has not been clearly defined in the literature. I have examined the type female and it fits in the dextioides subgroup, very near *biseta* (Grimshaw) and *brachydextioides* n. sp. It runs near the latter in my key and differs by having the interfrontal area not strongly narrowed at level of lower superior fronto-orbital bristles, two times wider than parafrontals (fig. 113a); by the male surstyli rounded at apex (fig. 113b) and terminal sclerites of female abdomen more elongate (fig. 101a).

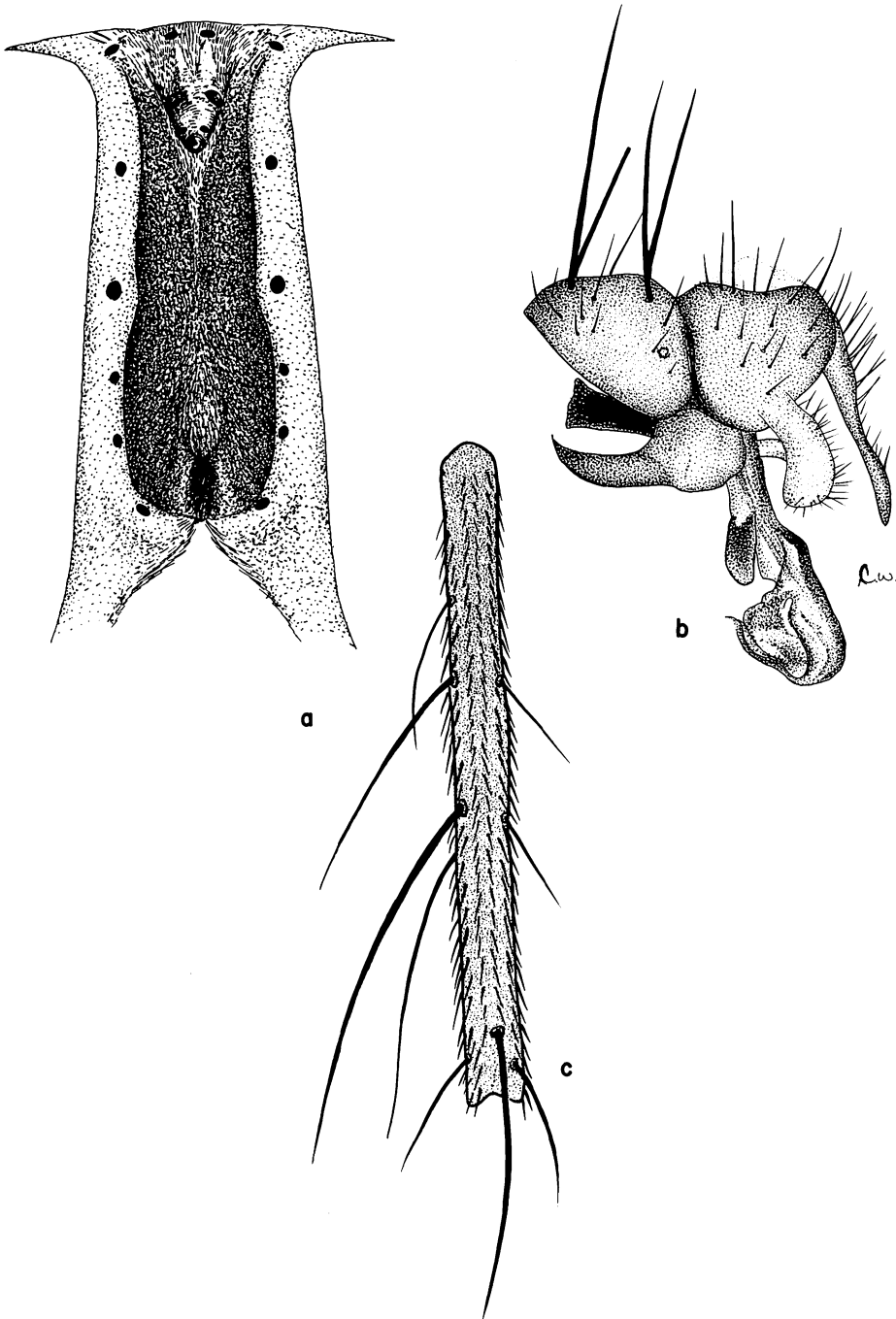


Figure 113—*Lispocephala valida* (Grimshaw): a, front of head; b, male genitalia, lateral; c, hind tibia, dorsal, drawn from type female.

The series of specimens on hand from a number of localities on Maui and Molokai show considerable variation in the coloration of the abdomen, especially in female specimens, from those which lack distinct spots as seen from direct dorsal view and which, when seen from end view, have brown paired spots on terga 3-5 (bordering on *pollinosa* Malloch) to the typical specimens which have prominent, large, paired spots on these terga. Otherwise fitting description of *brachydexioides*. Male genitalia as in figure 113b and terminal portion of female abdomen as in *biseta* (Grimshaw) (fig. 101a).

In the type, the humeri and much of the pleura and scutellum appear to be rufous or yellow in ground color, densely covered with yellow pollen. Bristles of hind tibia as in figure 113c. In the specimens on hand, some have the sides of the mesonotum, the humeri, scutellum, and all of the pleura, except lower median portion of sternopleuron, yellow, with the ground color completely obscured by the yellow pollen; these specimens also have less distinct abdominal markings as mentioned above. Most specimens of the series have the thorax entirely black in ground color, as is typical of *dexioides* and related species. The reliability of this character is not presently understood, the first mentioned specimens may eventually prove to be *pollinosa* or this may prove to be a synonym of *valida*.

***Lispocephala villosifemora* Hardy, new species (figs. 114a-d)**

Fitting borderline between the pallidibasis and the alakaiae groups of species but being placed as an aberrant dexioides subgroup (lacking the posterior bristle on front tibia) by the shape of the head, genital, and other characters. It is differentiated from all known species by having the posterior surface of the hind femur densely villose (fig. 114c).

MALE. *Head:* About as high as wide. Entirely golden pollinose except for the compound eyes, the reddish brown interfrontalia, and the dull black lunule. Ocellar triangle very short, the lower portion lightly pollinose and extending scarcely to lower superior fronto-orbitals. Antennae yellow, except for the black scape. Bases of aristae and all of palpi yellow. *Thorax:* Entirely golden pollinose. Only one pair of intraalar bristles. The first pair of presutural dorsocentrals is small, approximately two-fifths as long as second pair of bristles. Calypters white, faintly tinged with yellow on rims, and rather large, the lower extending almost one-half longer than scutellum and the upper covering about basal half of lower. *Wings:* Entirely hyaline. I see nothing distinctive about the venation, except that crossvein r-m is situated at about apical three-fifths of cell 1st M₂; also, the wings seem slightly narrower than is typical and are nearly three times longer than wide. *Legs:* Yellow, except for brown tarsi. Front basitarsus about one-half as long as tibia. Preapical dorsal bristles on front tibia approximately two-thirds as long as basitarsus. Front tibia and basitarsus with dense covering of short, black hair over ventral surface. Middle tibia with the setae on posterior and posteroventral surfaces two to three times longer than remainder of setae and the longest of these almost half as long as the

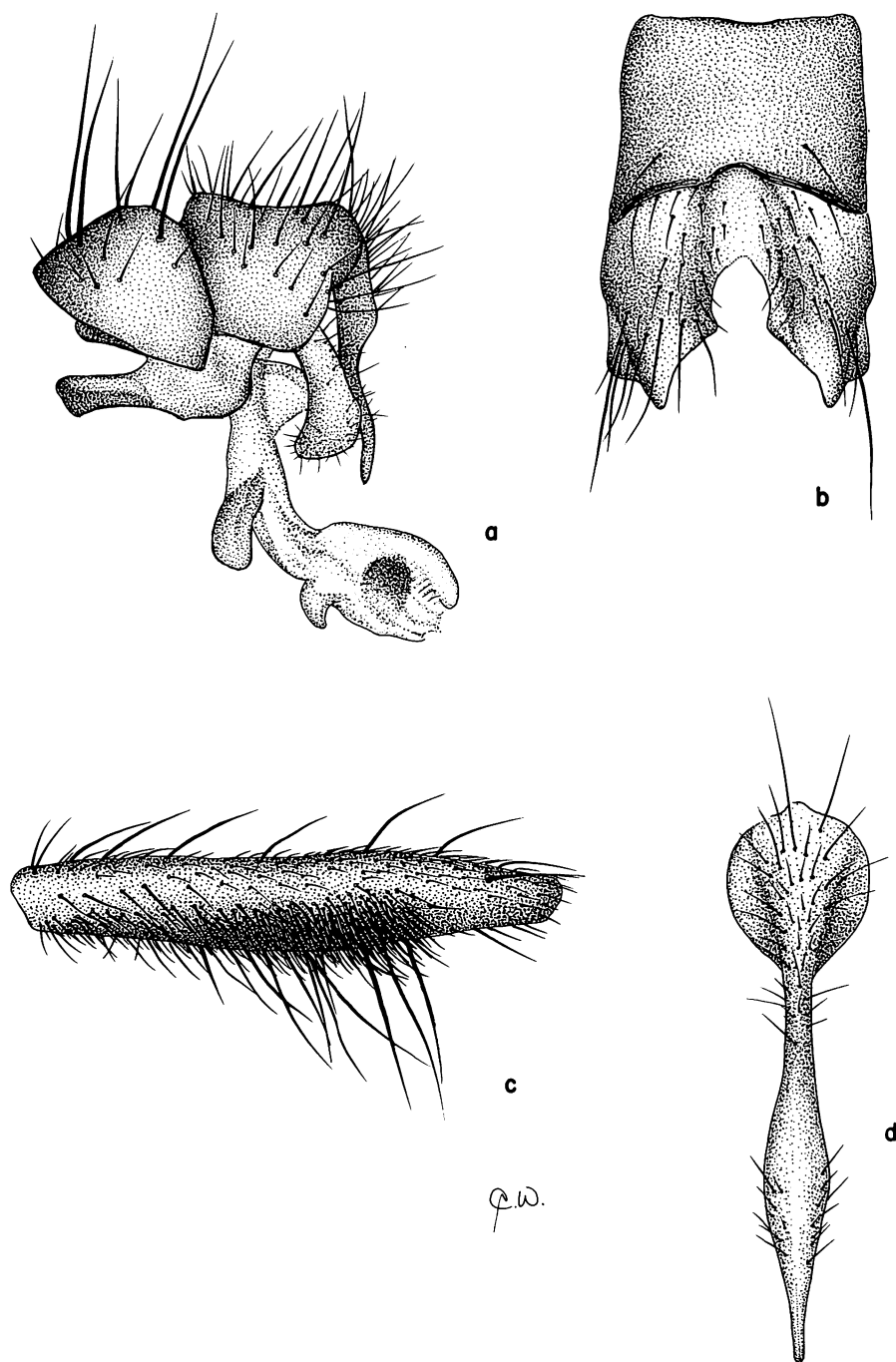


Figure 114—*Lispocephala villosifemora* n. sp.: a, male genitalia, lateral; b, fifth sternum of male; c, hind femur; d, extension of male cercus, end view.

posterior bristle. One anteroventral bristle on hind tibia (this is elongate) extending about four-fifths the distance to apex of segment. Hind tibia with a dense clump of short, black setae along posterior surface just before apex. Hind femur lacking preapical dorsal bristles, with a dense clump of black, posterior hairs at apical third, and with scattered, moderately long, black hairs along most of the posterior surface (fig. 114c). *Abdomen*: Entirely golden pollinose, basal three segments yellow in ground color and apical portion brown to blackish in ground color, with the coloration completely obscured by the golden pollen, except for a pair of small black spots on each of terga 4 and 5, best seen in end view. Fourth sternum densely covered with erect, black hairs. Fifth sternum as in figure 114b. Genitalia as in figure 114a. Extension from cercus abruptly tapered at middle, as seen in end view (fig. 114d). Surstyli enlarged at apices as in the species group which has a posterior bristle on front tibia and head as high as wide.

Length of body, 7.5 mm.

FEMALE. Unknown.

Holotype male: Honokane Nui Valley, Hawaii, August 11, 1970, 1,500 ft., reared from rotting bark of *Tetraplasandra* (F. L. Montgomery).

Type in B. P. Bishop Museum.

SEMINIGRA SUBGROUP

Differentiated by head broad, wider than high; front about as wide as high. Two pairs of strong, intraalar bristles present on mesonotum. Mid tibia with two posterior or posterodorsal bristles (except in *oahuae* Malloch) and one anterior or anterodorsal near median portion.

It seems probable that the posteromedian bristle of front tibia may be weak or absent in all of the males and well developed in the females. Posteromedians apparently are lacking in males of *oahuae* Malloch. Some males of *seminigra* (Grimshaw) have weak bristles present and in some specimens they are absent. *L. melanoxenina* n. sp. has rather well-developed posteromedians in the male. Males have not been seen for *xenina* Malloch and *subseminigra* n. sp. This subgroup is obviously intermediary between the pallidibasis and alakaiae groups of species.

***Lispocephala melanoxenina* Hardy, new species (figs. 115a-d)**

Fitting in the seminigra subgroup of species which have the head broad, wider than high and middle tibia with two posterior bristles near median portion. All other known members of this group also have one anterior or anterodorsal bristle near middle of mid tibia. This species appears to fit in or is closely related to the *xenina* complex. It is readily differentiated by being totally black, including all appendages, with even the halteres black—at least in the male; having no anterior bristle in middle of mid tibia; calypters dark colored with rims dark brown to black, fringed with brown hairs; a row of strong bristles developed along oral margin (fig. 115d); only one anteroventral bristle

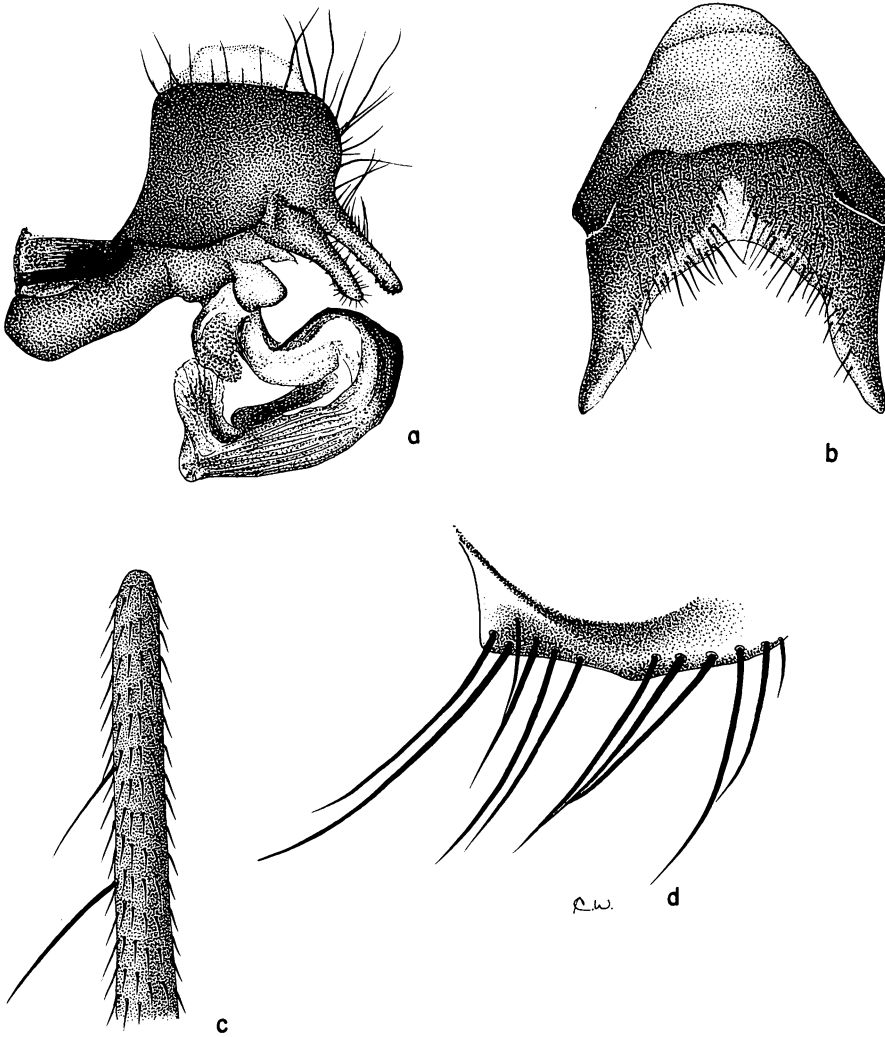


Figure 115—*Lispocephala melanoxenina* n. sp.: a, male genitalia, lateral; b, fifth sternum of male; c, mid tibia, dorsal; d, lower margin of head, showing vibrissal row.

on hind tibia. The male genitalia are also no doubt distinctive, the male of *xenina* has not been studied.

MALE. Head: Interfrontal area opaque black; ocellar triangle, vertex, parafrontalia, and upper parafacialia brown pollinose. Ocellar triangle extending slightly more than half the length of front, measured from median ocellus to anterior margin, ending about halfway between the lower superior fronto-orbital and upper inferior fronto-orbitals. Face yellow-gray pollinose. Antennae and palpi entirely black. Third antennal segment three times longer

than wide. Aristae pubescent. Palpi with numerous short, black setae over apical three-fourths and gently clavate. Vibrissal row consisting of about eight strong bristles (fig. 115d). *Thorax*: Entirely subopaque, gray-brown pollinose with no indications of markings on mesonotum. Two strong, presutural dorsocentrals and two pairs intraalar bristles. *Legs*: Completely black. Front femur with a row of strong posteroventrals, a row of moderately developed posterodorsals, and with abundant erect bristle-like setae over posterior surface. Posterior bristle at middle of front tibia extending slightly over half the distance to apex of segment. Middle tibia with two strong, posterior bristles situated just below middle of segment (fig. 115c) and with no evidence of an anterior bristle. Hind femur with no preapical dorsal bristles but with a bristle situated just posterior of the dorsal line and with no bristle in the true posterodorsal position. Hind tibia with one anteroventral situated near apical two-fifths of segment. *Wings*: Infuscated with brown, more distinctly brown along the veins. Crossvein r-m situated at middle of cell 1st M_2 . Calypters infuscated with brown, the rims dark brown to blackish. *Abdomen*: Entirely subshining, subopaque black, covered with gray-brown pollen, and with very narrow indications of gray across posterior margins of terga. Fifth sternum shaped as in figure 115b and male genitalia as in figure 115a. The extension from cercus is sharply concave in middle of upper margin, has strong bristles on dorsal portion of basal two-thirds, and with stout ventral spicules on apical third. Surstyli rather broad, curved upward, and with abundant setae around margins. Aedeagus very large, rather complex, strongly convoluted, and a lobe is present on medioventral portion which is very densely spiculated.

Length: body, 8.0 mm.; wings, 7.0 mm.

FEMALE. Fitting description of male except for genital characters. Length of body, 7.25 mm.

Holotype male: Upper Hana Forest, Maui, 6,100 ft., July 7, 1973 (D. E. Hardy). Allotype female: Haleakala, Maui, near Keanai Pali, 5,800 ft., July 19, 1919 (no collector given).

Type and allotype in B. P. Bishop Museum.

***Lispocephala oahuae* Malloch (figs. 116a-c)**

Lispocephala oahuae Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):87. Oahu (type-locality: Opaeha). Type male in B. P. Bishop Museum.

Lispocephala seminigra Malloch (not Grimshaw), 1928, Proc. Haw. Ent. Soc. 7(1):79. Female specimens from Oahu.

Fitting in the *seminigra* subgroup with the males lacking a posteromedian bristle on front tibia. The species is readily differentiated by the distinctive male genitalia, with the process of the cercus and the surstyli bent strongly upward at apices (fig. 116a); also, the r-m crossvein is situated slightly beyond middle of cell 1st M_2 so that the penultimate section of vein $M_1 + 2$ is short, compared to the last section of that vein, scarcely over one-third its length (fig. 116b); the proportions of the last section of $M_1 + 2$ to the penultimate section are 5.9 to 2.3.

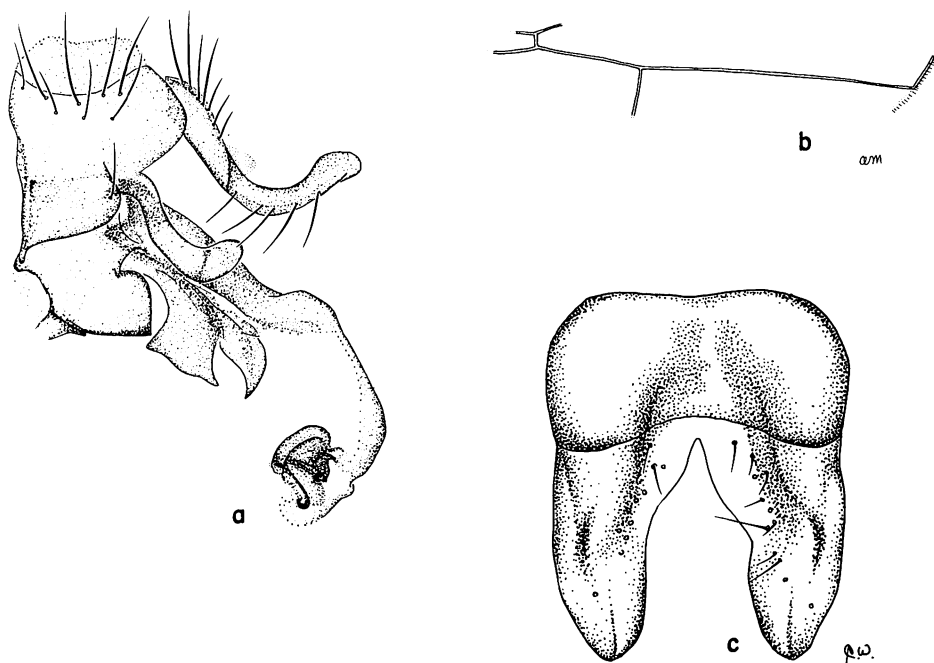


Figure 116—*Lispocephala oahuae* Malloch: a, male genitalia, lateral; b, last two sections of vein $M_1 + 2$; c, fifth sternum of male.

A rather small species with legs, palpi, antennae, bases of aristae yellow; also with first two terga entirely yellow, except for a faint tinge of brown down median portion and base of third tergum, broadly yellow on sides. Ocellar triangle and eye orbits gray, the former extending to or slightly beyond level of upper inferior fronto-orbitals. Aristae moderately plumose. The first pair of postsutural dorsocentrals small, approximately equal in size to the anteromedian acrostichals, and equal to or slightly smaller than the anterior intraalars. Male lacking posterior bristles in middle of mid tibia. Hind femur with one preapical dorsal bristle and hind tibia with two anteroventrals situated just beyond middle of segment. Calypters white, wings subhyaline. Apical portion of third tergum reddish-brown, gray pollinose on extreme margin. Fourth and fifth terga subshining black, covered with gray pollen, and with apical margin of fourth gray, lacking paired, black spots. Genitalia reddish-brown, fifth sternum deeply cleft in middle and with lateral lobes broadly rounded (fig. 116c); other details of the genitalia as mentioned above and as in figure 116a.

Length: body, 3.75 mm.

Females with a strong, median posterior bristle on front tibia and with two posterior bristles and one anterior bristle near middle of mid tibia. Fitting near *seminigra* (Grimshaw), differing by having the interfrontalia brown in ground color, gray pollinose; aristae shorter plumose, with the longest hairs much less than the width of third segment; humeri mostly yellow in ground color and

third tergum nearly all yellow. The specimens are also slightly smaller, the body measures 3.5–4.0 mm.

***Lispocephala seminigra* (Grimshaw) (figs. 117a–f)**

Coenosia seminigra Grimshaw, 1901, Fauna Hawaiiensis 3(1):33.

Lispocephala plumiseta Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):79. **New synonym.** Synonymy based upon comparison of a series of specimens from the Kilauea region and other areas of Hawaii, study of Grimshaw's type male in the British Museum (Natural History), and Malloch's type male in B. P. Bishop Museum.

Endemic. Hawaii (type-locality of *seminigra*: Kilauea; of *plumiseta*: Glenwood).

Fitting nearest *oahuae* Malloch, from Oahu, but differs by having interfrontalia yellowish to orange; aristae long plumose (fig. 117d), the longest hairs about equal to or slightly longer than width of third antennal segment; humeri black in ground color and third tergum of abdomen mostly black. The fifth sternum of the male is conspicuously produced and with a pointed apical lobe on each side. The male genitalia are as in figure 117b (drawn from specimen from Kohala Mts. which has no posteromedian bristle on front tibia). The fifth sternum of the male is as in figures 117b,e,f. The posteromedian bristle of the front tibia of the male is rather short; in the types of both *seminigra* and *plumiseta*, extending only about one-fourth the distance to apex of segment (fig. 117c). It is apparent that some males may lack the posteromedian bristle on the front tibia and would fit in a completely different portion of the key. Four males from Hawaii fit all the characteristics of *seminigra*, including *in situ* comparison of male genitalia with the type of *plumiseta*, except that they lack the posteromedian bristle on the front tibia. In the female, the bristle is strong, extending to about apex of segment. Bristles of mid tibia as in figure 117a. The ocellar triangle extends to about a level with upper inferior fronto-orbital bristles. The palpi have a number of moderately long hairs along posteroventral and anteroventral margins. Two pairs of strong intraalar bristles present. Calypters white, tinged faintly with yellow. Two strong anteroventral bristles present on hind tibia.

Length: body, 4.5–5.0 mm.

***Lispocephala* new species 'A' ? female, *seminigra* complex**

One female specimen from Paliku, Haleakala Crater, Maui, 6,500 ft., July 24, 1963 (D. E. Hardy), appears to be a new species near *seminigra* (Grimshaw), which differs by having the abdomen all black except for narrow sides of terga 1 + 2; third antennal segment black except at base; aristae pubescent; all femora broadly brown to black over median portions; mesonotum and scutellum brown pollinose except on margins, and interfrontalia entirely dark brown to black.

More specimens will need to be seen and the males associated before this can be placed.

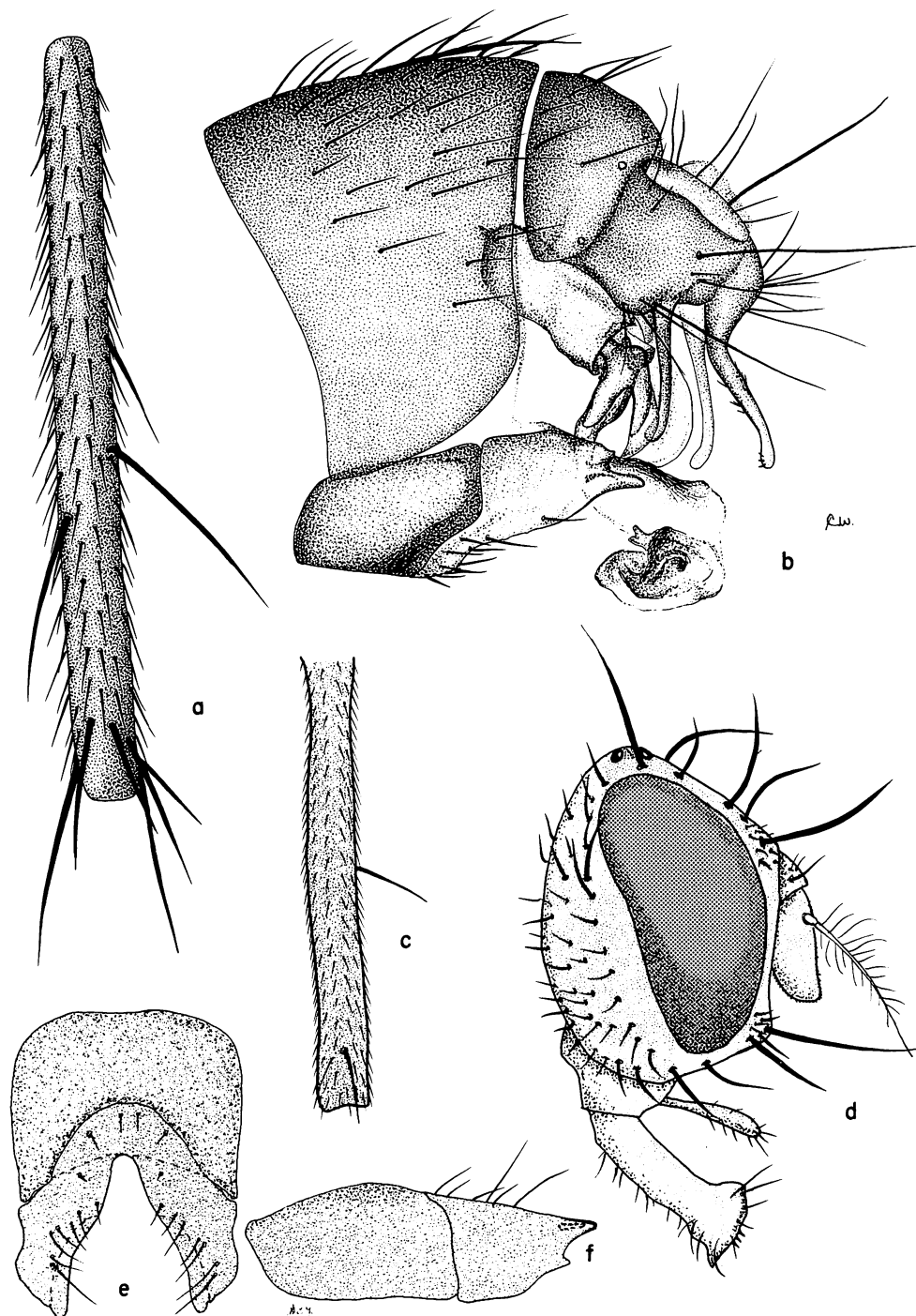


Figure 117—*Lispocephala seminigra* (Grimshaw): a, mid tibia, dorsal, drawn from type male; b, male genitalia, lateral; c, front tibia, dorsal, drawn from type male; d, head, lateral; e, fifth sternum of male, ventral; f, fifth sternum, lateral.

***Lispocephala* new species 'B' ? female, seminigra complex**

One female from Mt. House Road, above Naalehu, Hawaii, August 14, 1968 (J. A. Tenorio) is similar to n. sp. 'A', *seminigra* complex, but differs by having the aristae plumose; ocellar triangle short, ending about opposite lower superior fronto-orbitals, rather than to level of upper inferior fronto-orbitals; mid and hind femora shining black except for narrow apices of mid; front femora yellow, tinged with brown medianly; mesonotum and scutellum subshining black and abdomen shining black; also, the wings are infuscated with brown over anteroapical portion, rather than being subhyaline.

One female from Kiilae, S. Kona, Hawaii, 5,300 ft., August 21, 1936 (E. Y. Hosaka), is similar to the above but the basal two terga and sides of third are mostly yellow and the mid and hind femora are broadly yellow basally; also the wings are less intensely infuscated.

More specimens are needed to place these.

***Lispocephala subseminigra* Hardy, new species**

Fitting in the *seminigra* subgroup of species near *seminigra* (Grimshaw) and differing by having the female abdomen entirely black except for narrow lateral margins of terga 1 + 2, also the interfrontal area blackish on upper portion above middle of front and ocellar triangle; parafrontalia and parafacialia are pale golden pollinose, rather than gray; the specimens are also larger—body, 5.5–6.25 mm. Otherwise fitting *seminigra*, with antennae all yellow, aristae long plumose, and legs all yellow except for brown tarsi.

MALE. Unknown.

Holotype female: Puu Kukui Ridge, Maui, 3,500 ft., September 28, 1973 (D. E. Hardy). One female paratype same locality and collector as type, July 21, 1971.

Type in B. P. Bishop Museum. Paratype in University of Hawaii collection.

***Lispocephala xenina* Malloch**

Lispocephala xenina Malloch, 1938, Proc. Haw. Ent. Soc. 7(1):78.

Endemic. Hawaii (type-locality: S. Kona). Type female in B. P. Bishop Museum.

Belonging in the *seminigra* subgroup in a complex of species characterized by having the antennae and legs mostly or entirely black. By having the aristae plumose, palpi yellow, and usually two anteroventral bristles on hind tibia, it would fit the nearest to n. sp. 'A', *xenina* complex, but differs by having a strong anterodorsal bristle at apical third of middle tibia, only one preapical dorsal bristle on hind femur, and mesonotum and most of abdomen subshining brown to black, lightly brownish pollinose.

In most specimens, the antennae are entirely black. Front dark brown to blackish with the orbits gray-brown and ocellar triangle brown pollinose, ex-

tending almost to a level with upper, inferior fronto-orbital bristles. Mesonotum and scutellum mostly subshining, black in ground color covered with brown pollen, gray pollinose around margins. Two pairs of strong intraalar bristles present. Calypters yellowish, with rims tinged faintly with brown. The wings are evenly pale brown, slightly darker along anterior portion, and the r-m crossvein is situated just slightly before middle of cell 1st M_2 . Legs entirely dark colored except for extremely narrow bases of tibiae; with femora entirely black and tibiae yellow-brown. The posterior bristle on front tibia extends about two-thirds to three-fourths the distance to apex of segment. Typically with two strong anteroventral bristles on hind tibia; one specimen on hand has only one anteroventral. Abdomen entirely subshining black, narrowly gray at apices of terga.

Length: body, 4.5–5.0 mm.

The male has not yet been seen.

Lispocephala new species 'A' ? female, xenina complex

A female from Kipahulu Valley, Maui, 1,250 m., August 13–17, 1967 (N. Wilson), fits near *xenina* Malloch but differs by lacking an anterodorsal bristle on middle tibia; having two preapical dorsal bristles on hind femora; mesonotum brown pollinose with faint gray vittae and abdomen gray pollinose with brown marks in middle of terga.

More specimens need to be studied.

FASCICULATA GROUP OF SPECIES

A small group of aberrant species occur over the islands which are characterized by having only one pair of strong scutellar bristles. Using Hennig's key to the palaearctic genera (1960:471) and Crosskey's key to the genera of Oriental and Australasian Coenosiinae (1962:400), these would seem to run to or near the genus *Orchisia* Rondani. These are not related. In the Hawaiian species, it is the basal scutellars which are strong and the apical pair greatly reduced. In *Orchisia*, also *Spanochaeta* Stein, the apical scutellars are well developed and the basal pair lacking. Also, the Hawaiian species differ from *Orchisia* by having lower lobe of calypter projecting well beyond upper; ocellar bristles strong; wings entirely hyaline; and hind tibia with three posterodorsal bristles. This is not a natural grouping and two distinct complexes of species are represented: In one, the females have strong posterior bristles in middle of front tibia and middle tibia has two strong posteriors and one strong anterior bristle. The males of this group have a weak posterior bristle on front tibia, or the bristle may be absent; the middle tibia has one moderately developed posterior and sometimes one secondary weak posterior, and the anterior bristle is lacking. Also, the hind tibia has two anteroventral bristles. In the other complex, the bristle arrangement of the legs is the same in both sexes, the posteriors are lacking on front tibiae, one median is present on middle, and one anteroventral is present on hind tibiae.

The head is comparatively broad in all of the two-scutellar species, wider than high with the front moderately broad, and two well-developed intraalar bristles are present.

Seven species fit in this group, two (*fasciculata* Malloch and *pallida* Malloch) have the posteromedian bristle on front tibia, at least in the females. Five (*macrocera* n. sp., *quasipallida* n. sp., *subtilis* n. sp., *uniseta* n. sp., and *waialealeae* n. sp.) lack this bristle.

***Lispocephala fasciculata* Malloch (figs. 118a-e)**

Lispocephala fasciculata Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):82.

Endemic. Hawaii (type-locality: Kilauea). Type male in U.S. Nat. Museum.

Fitting in the group of species which have only one pair of strong, subbasal, scutellar bristles, the apical pair rudimentary. It fits nearest to *pallida* Malloch by having a strong posteromedian and one strong anteromedian bristle on middle tibiae. In the male, a rudimentary posterior bristle is present on front tibia of *fasciculata*, absent in *pallida*; the middle tibia lacking an anterior bristle and with one moderately strong posteromedian bristle and sometimes a rudimentary secondary posterior bristle (as in *pallida*). *L. fasciculata* is readily differentiated by the predominantly black body, the prominent fascicula of stout, black bristles at apices of first two tarsomeres of front legs (fig. 118c), by genital characters (fig. 118a), as well as other details.

Antennae, palpi, and legs, except for apical tarsomeres, yellow; mid and hind coxae tinged with brown. Front mostly black, or dark in ground color, yellow to orange immediately above antennae; ocellar triangle extending to about a level with upper inferior fronto-orbital bristles. Arista moderately plumose. Thorax densely gray pollinose, non-vittate. Two pairs of well-developed intraalars present. Front tibia of male with a small, median, posterior bristle, this is about two times longer than the setae along posterior margin. In the female, the posterior bristle is strong, extending three-fourths to four-fifths the distance to apex of segment. In the male, a rather prominent posterior bristle is present in middle of segment and a small secondary posterior is located just above, near basal third of segment in some specimens. No anterior bristle is present on male. In the female, two strong posterior bristles and one strong anterior are located in median portion of tibia. Hind tibia with two anteroventral bristles. Calypters pale yellow-white, the upper is about half as long as lower. Wings very faintly tinged with brown anteriorly. First three abdominal segments largely yellow, black down median portion; the median vitta is much broader in the female. Terga 4 and 5 subshining black, medianly gray on sides and along basal margins. Fifth sternum of male developed into a long pointed lobe on each side (figs. 118d,e). The lobe from the cercus is strongly curved upward before the apex and has conspicuous, preapical ventral setae. Surstyli long and slender. Other genital characters as in figure 118a. Female spermathecae as in figure 118b.

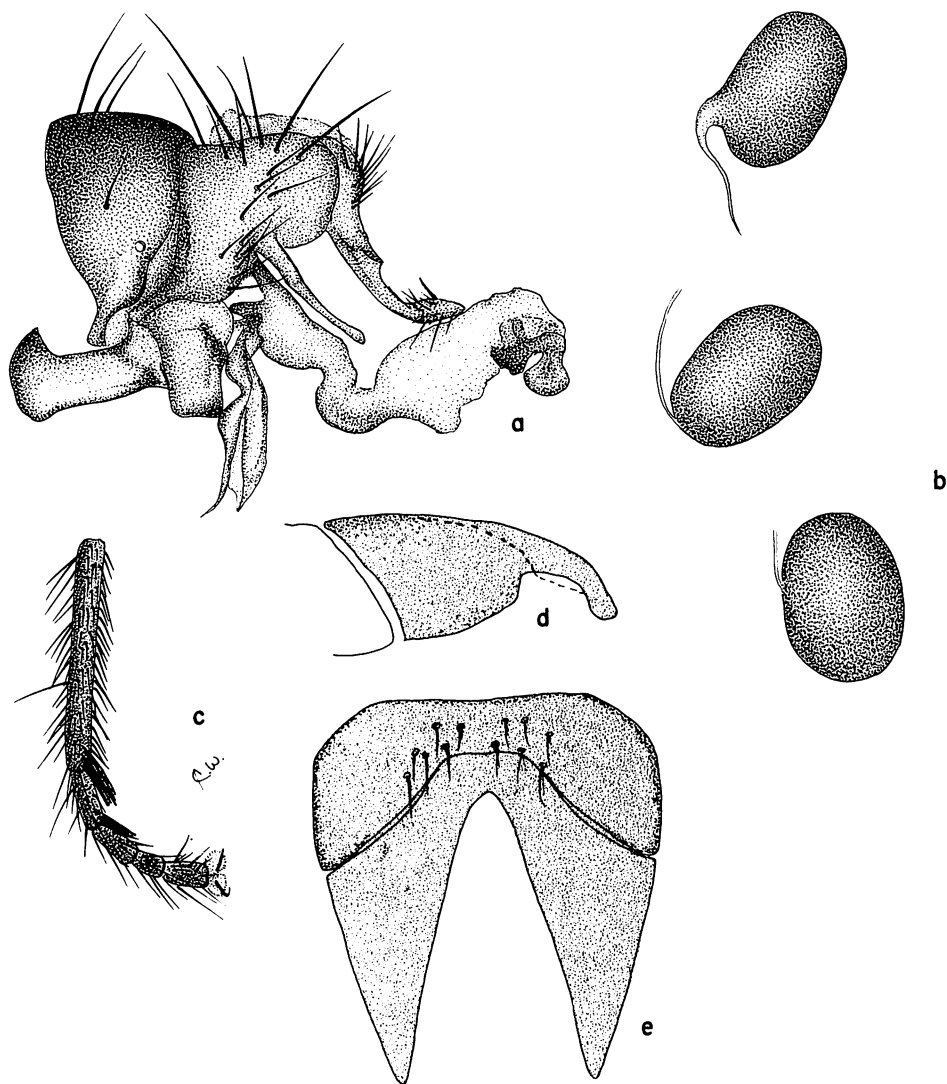


Figure 118—*Lispocephala fasciculata* Malloch: a, male genitalia, lateral; b, spermathecae of female; c, front tarsi of male; d, fifth sternum of male, lateral; e, fifth sternum, ventral.

Length: body, 3.5–4.0 mm.

It should be noted that Malloch keyed this species in the group which have four strong, scutellar bristles; however, in his description he said “apical scutellar bristles lacking in type, but probably shorter than other pair.”

Numerous specimens have been seen from the Kilauea area and from the Saddle Road on Hawaii, elevation 4,000–5,000 ft. This is the first record for the female. It has previously been known only from the type male.

***Lispocephala macrocera* Hardy, new species (figs. 119a-c)**

Belonging in the fasciculata group of species in the macrocera subgroup which have no posterior bristles on front tibiae and only one anteroventral on hind tibia. It runs near *subtilis* n. sp., from Hawaii, and appears to show some relationship to that species because of the enlargement of the male aedeagus. *L. macrocera* is readily differentiated, however, by the entirely black antennae, with the third segment elongate (fig. 119c). Also the shapes of the surstyli, the extension from the cercus, and other genital characters are very different in the two species (figs. 119a, 121a).

MALE. *Head:* About one-fifth wider than high, as seen from direct frontal view. Front broad, one-third wider than long, measured from median ocellus to lunule. The front is mostly opaque black; the lower portion above lunule is dull rufous. The frontal orbits and the ocellar triangle are gray-brown pollinose, the latter extends to a level with upper inferior fronto-orbital bristles. Face gray. Palpi with several short setae at apex and a number along venter and sides. Antennae entirely black, third segment elongated, extending almost to the oral margin (fig. 119c). Arista long pubescent to short plumose, with most of the hairs on the dorsal surface. Palpi yellow, with several short black setae at apices. *Thorax:* Black in ground color, rather densely brownish-gray pollinose, and with mesonotum not vittate. Two intraalars present. The apical scutellar bristles are variable in size, typically they are small, seta-like, approximately one-fifth as long as outer bristles; they range in size up to nearly half as long as outer bristles. Calypters pale yellow-white, the upper is about one-half as long as the lower. *Wings:* Faintly infuscated. Crossvein r-m situated near middle of cell 1st M₂. *Legs:* Mostly yellow with a tinge of brown on apices of mid and hind femora and with the tarsi dark brown to black. No posterior bristle on front tibia, middle tibia with one posterior at middle of segment and hind tibia with one anteroventral bristle just beyond middle. Other bristles of hind tibia as is typical of this group of species. No preapical dorsal bristles on hind femora. Front basitarsus just slightly over half as long as the tibia and the first two tarsomeres are subequal in length to the tibia. *Abdomen:* Mostly black with sides of first three terga broadly yellow. Fifth sternum not produced ventrally, the posterior lobes are broadly rounded and separated by a comparatively shallow V-shaped suture (fig. 119b). Surstyli bi-lobed ventrally and process extending from cercus hooked at apex. Aedeagus greatly enlarged at apex (fig. 119a).

Length: body, 3.5 mm.; wings, 3.0 mm.

FEMALE. Fitting description of male except that the third antennal segment is not quite so elongate and the abdomen is mostly subopaque brown, yellow on sides of first two terga. I see nothing distinctive about the terminal portion of the abdomen, these segments are comparatively short and thick.

Length: body and wing, 4.0 mm.

Holotype male and allotype female: Waikamoi, Maui, 4,000 ft., August 14, 1964 (D. E. Hardy). Approximately 200 paratypes, sexes about evenly

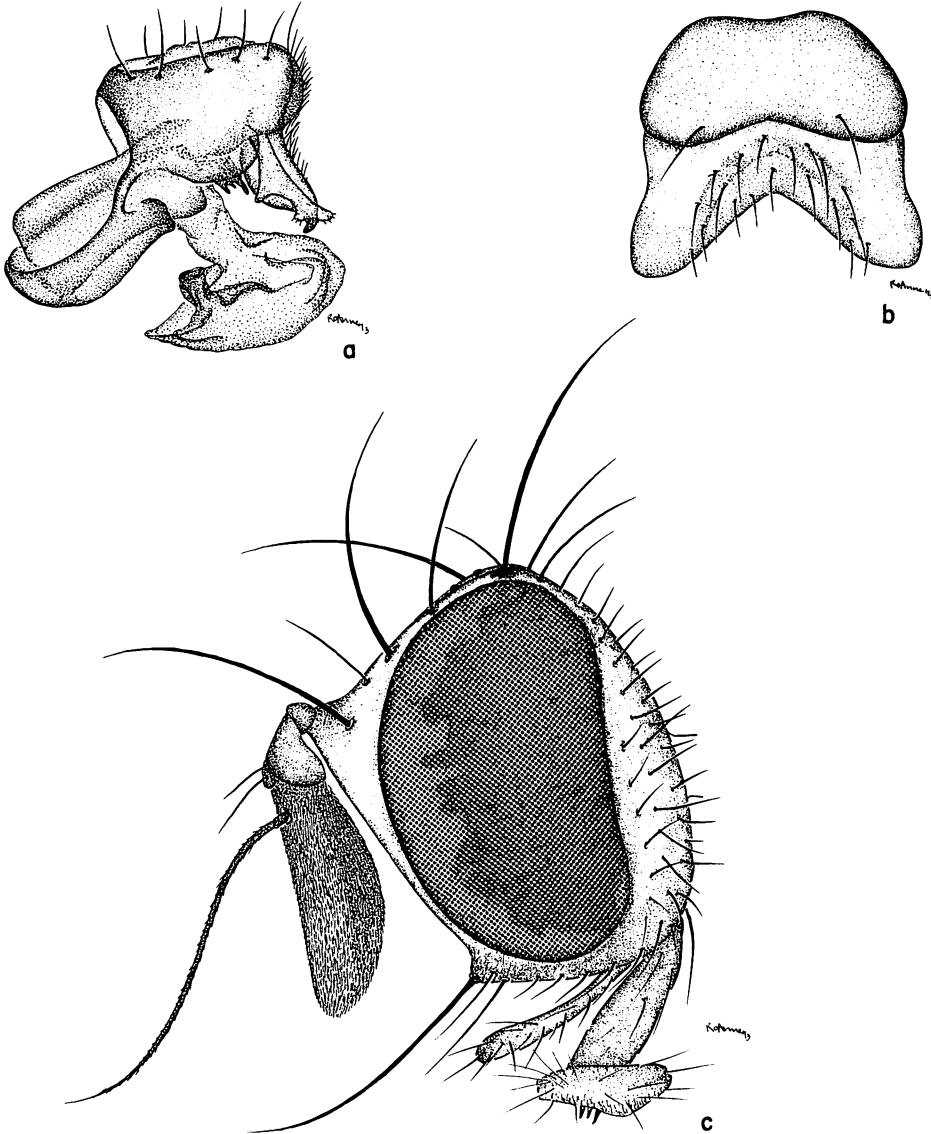


Figure 119—*Lispocephala macrocera* n. sp.: a, male genitalia, lateral; b, fifth sternum of male; c, head, lateral.

distributed, mostly from the type locality and the Olinda-Waikamoi forest region on the slopes of Haleakala, from 3,000–5,000 ft. elevation, collected over a period of several years by a number of collectors (D. E. Hardy, J. P. Murphy, H. T. Spieth, C. Kanapi, W. S. Stone, J. A. Tenorio, and J. R. Vockeroth). Also from numerous localities over entire island of Maui,

both on Haleakala and West Maui: trail to Honomanu Valley, 5,300 ft., July 24, 1965 (D. E. Hardy); ridge to Puu Kukui above Kaulalewelewe, 3,000–4,000 ft., August 3, 1964 (D. E. Hardy); and October 25–27, 1966 (T. Saigusa); Haelaau, 3,000 ft., December 17, 1928 (E. H. Bryan and O. H. Swezey); Kipahulu Valley, 1,250 m., August 1967 (N. Wilson).

Type, allotype, and series of paratypes in B. P. Bishop Museum. Paratypes in the collections of the U.S. National Museum, British Museum (Natural History), Canada Department of Agriculture, and the University of Hawaii.

This is one of the most abundant species on Maui and also on the mountains of Molokai, especially in the Puu Kolehaha region. Specimens from Molokai are not being designated in the type series. It is found in close association with the native *Drosophilidae* and is no doubt a very important predator upon these, as well as other insects in the rain forest.

***Lispocephala pallida* Malloch (figs. 120a–e)**

Lispocephala pallida Malloch, 1928, Proc. Haw. Ent. Soc. 7(1):72.

Endemic. Oahu (type-locality: Palolo Crater). Type male in B. P. Bishop Museum.

Belonging in the *fasciculata* group, which has a strong posteromedian bristle on front tibia of female and lacking this bristle on male; middle tibia with two posteriors and one anterior (fig. 120c), these are strong in the females and poorly developed in the males; also hind tibia with two anteroventral bristles in both sexes. Because of the leg bristling it would fit nearest to *fasciculata* Malloch, from Hawaii, but it differs strikingly by having the thorax yellow, except for a longitudinal median brown to blackish mark between dorsocentral rows; hind tarsi of male without fasciculae; front tibia lacking posterior bristle in male, also the development of the male fifth sternum and genitalia are completely different in the two species (figs. 118a,d,e and 120a,d,e).

Head yellow, except for brown ocellar triangle and faint discoloration of brown over upper portion of occiput in male; in female, the entire vertex and upper occiput are brown to black. Aristae long plumose, the longest hairs are equal in width to third antennal segment. Two pairs of intraalar bristles present. The apical scutellars are usually equal in size to the second pair of intraalars. The abdomen is mostly yellow, discolored with brown to black down median portions of terga; the amount of dark coloring is variable but in females, especially terga 3–5 are intensively brown to black over the dorsal portions. The fifth sternum of the male is less strongly lobate than in *fasciculata* and, as seen from direct lateral view, is rounded at apices (fig. 120d), from ventral view it is as in figure 120e. The development of the apex of the cercus as well as other details differ, as in figure 120a. The female spermathecae are narrowed basally, somewhat pear-shaped (fig. 120d), differing completely from those of *fasciculata*.

Length: body, 3.0–5.0 mm.

This species has been collected from numerous localities in the mountains of Oahu.

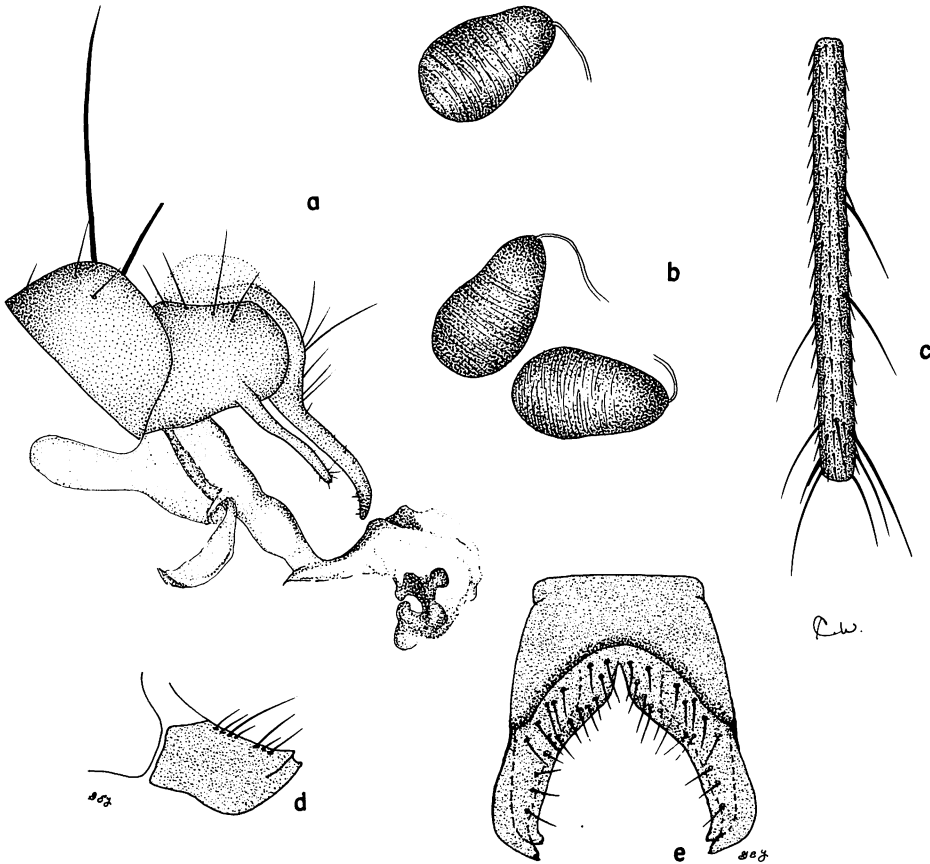


Figure 120—*Lispocephala pallida* Malloch: a, male genitalia, lateral; b, spermathecae of female; c, mid tibia, dorsal; d, fifth sternum of male, lateral; e, fifth sternum, ventral.

***Lispocephala quasipallida* Hardy, new species**

Fitting in the fasciculata group, which have rudimentary apical scutellar bristles, and resembling *pallida* by having the body mostly yellow. The resemblance is superficial and *quasipallida* would fit in an entirely different species complex by lacking a posterior bristle in middle of front tibia; having only one posterior bristle in middle of mid tibia and no anterior bristle; hind femur lacking a preapical dorsal bristle and arista pubescent, rather than long plumose.

FEMALE. Head and appendages: Entirely pale yellow except for the reddish brown eyes, black ground color of ocellar triangle, and a faint tinge of brown in ground color of upper portion of occiput. Entirely silvery gray pollinose. Ocellar triangle scarcely differentiated, extending slightly beyond lower superior fronto-orbital bristles. Palpi with short yellow setae at apices. **Thorax:** Pleura, humeri, and sides of mesonotum pale yellow, gray pollinose; median

portion of mesonotum, between area bounded by presutural and postalar bristles, tinged with brown in ground color and covered with gray pollen; also a narrow streak of yellow extends across mesonotum in line with the suture. Scutellum tinged with brown on sides, yellow down median portion, apical bristles about one-fourth as long as basals. Two intraalar bristles present. Calypters pale yellow-white, the upper extends about two-thirds to three-fourths the length of the lower. *Wings*: Subhyaline, crossvein r-m at middle of cell 1st M_2 , and the short spinules along costa extend about two-fifths the distance between apices of veins $R_2 + 3$ and $R_4 + 5$. *Legs*: Entirely yellow with a faint tinge of brown on tarsi. Front basitarsus about half as long as tibia. The bristling as mentioned in the introduction above. Only one anteroventral bristle just beyond middle of hind tibia. *Abdomen*: Yellow on sides and at base, tinged with brown over median portions of terga 2-5.

Length: body and wings, 3.2-3.5 mm.

MALE. Unknown.

Holotype female: Koaie Valley, Kauai, 3,600 ft., June 21, 1966 (K. Y. Kaneshiro).

Type in the B. P. Bishop Museum.

***Lispocephala subtilis* Hardy, new species (figs. 121a,b)**

Fitting in the fasciculata group of species and belonging in the complex which lack posterior bristles in middle of front tibiae. Fitting near *macrocera* n. sp., from Maui and Molokai, but differing by having the third antennal segment normal in shape, not elongated; also by having the third segment rufous on inner basal portion; the hind femora entirely rufous and the genitalia are completely different in development; the projection from the cercus is not bent downward, hook-like at apex; the surstyli are long and slender, not lobate ventrally, and so on (figs. 119a and 121a).

MALE. Fitting characteristics of most species of this complex, with the head and thorax entirely black in ground color. The lower interfrontal area is brown, tinged with rufous, and remainder of the front is black with orbits broadly gray and ocellar triangle gray, extending approximately to a level with upper inferior fronto-orbitals. Antennae black except for rufous base on inner margin of third segment. Aristae short plumose. *Legs*: Fitting the characteristics of other members of this group and with one strong anteroventral on hind tibia and no preapical dorsal bristle on hind femur. Front coxae yellow except for extreme bases. *Wings*: Subhyaline. *Abdomen*: With basal two-three terga mostly yellow, faintly tinged with brown down median portion and with apical segments of abdomen brown to black. Genitalia as noted above and as in figure 121a. Fifth sternum cleft nearly half its length on hind margin and shaped as in figure 121b.

Length: body, 4.0 mm.; wings, 4.4 mm.

FEMALE. Fitting description of male except that the face has a faint golden tinge in the pollinosity, the thorax is indistinctly vittate with three narrow,

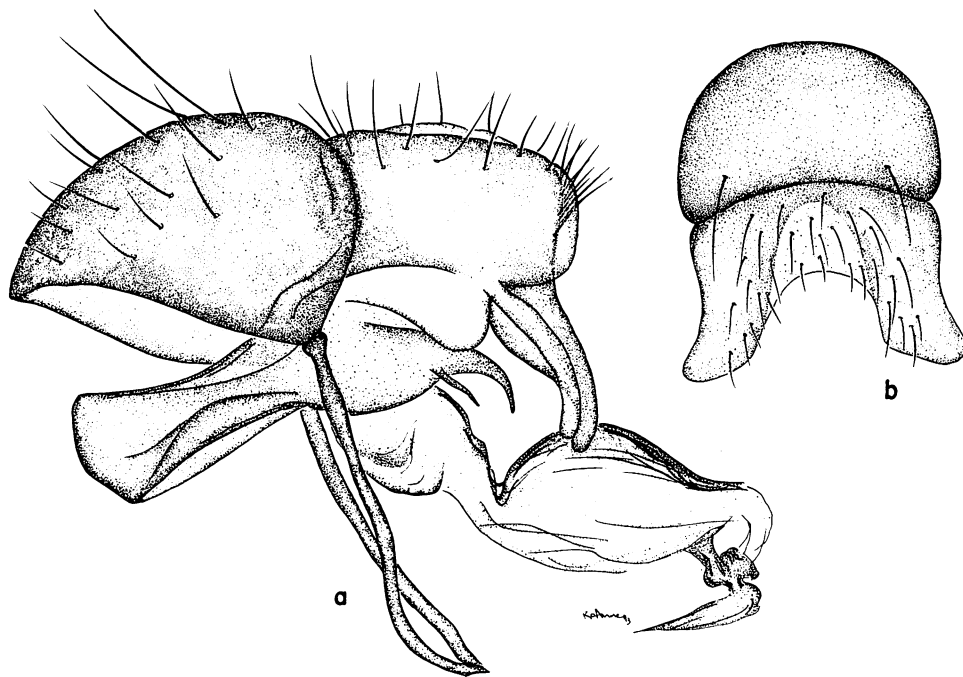


Figure 121—*Lispocephala subtilis* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral.

rather faint, brown vittae. Also, the abdomen is entirely black, faintly tinged with yellow on extreme lateral margins of basal segments.

Length: body, 4.0 mm.

Holotype male: "Kipuka No. 9," Saddle Road, Hawaii, 5,000 ft. elevation, January 19, 1972 (D. E. Hardy). Collected in association with native *Drosophila*, in rain forest. Allotype female: Kilauea Forest Reserve, Hawaii, 5,200 ft., malaise trap #1, October 26–November 2, 1970 (W. A. Stephan and F. Bianchi).

Type and allotype in B. P. Bishop Museum.

***Lispocephala uniseta* Hardy, new species (figs. 122a,b)**

Fitting in the fasciculata group of species in the complex which lack a posterior bristle in middle of front tibia. Resembling *fasciculata* Malloch by having the thorax all black and the antennae yellow but showing no relationship to this species. It is readily differentiated by having no fasciculae on front tarsi, lacking a preapical dorsal bristle on hind femur, and having only one anteroventral bristle on hind tibia. The genital characters are completely different, the fifth sternum is not projected (figs. 118d,e and 122a) and the characteristics of the genitalia are very different as shown in figures 118a and

122b. Showing closer relationship to *subtilis* n. sp. but differing by having the antennae all yellow and the coxae and trochanters rufous, not dark brown to black; interfrontalia largely rufous, not mostly black and the genital characters differ as shown in figures 121a and 122b.

MALE. *Head:* Mostly black in ground color, with median portion of front rufous, tinged very faintly with brown. Frontal orbits gray pollinose and face entirely silvery-gray. Frontal triangle rather faint, extending almost to upper inferior fronto-orbital bristles. Antennae entirely yellow. Arista brown except for the base and short plumose to long pubescent. Palpi entirely yellow with rather numerous black setae. *Thorax:* Black in ground color, gray pollinose at sides, gray with a faint tinge of brown on dorsum. Two intraalar bristles. Apical scutellars poorly developed and situated close together. *Wings:* Faintly tinged with brown, and r-m crossvein situated slightly before middle of 1st M_2 . Fringe of short spines on costa extending half the distance between apices of veins $R_2 + 3$ and $R_4 + 5$. Calypters pale brownish yellow, the upper covers the basal half of the lower. *Legs:* Yellow to rufous except for the brown tarsi. The bristling as in the other members of this complex but with only one anteroventral bristle on hind tibia and with one preapical posterodorsal bristle, but no dorsal bristle, on hind femur. *Abdomen:* First tergum yellow, tinged with brown on sides; second all yellow; third yellow on anterior margin and narrowly tinged with yellow on posterior margin; terga otherwise black, with a faint rufous tinge on 3 and 4. Genitalia as in figure 122b, with the surstyli rather strongly bent downward and with the aedeagus large, expanded at apex. Fifth

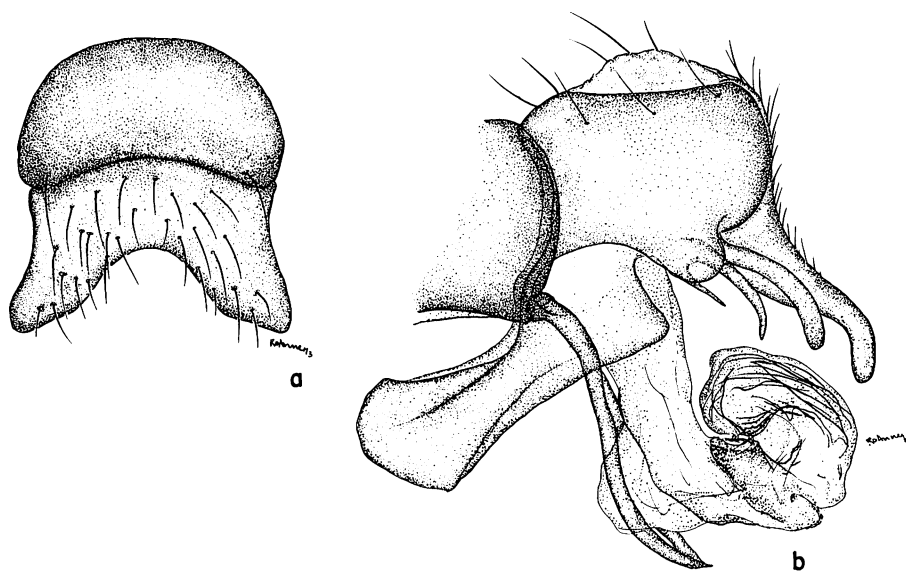


Figure 122—*Lispocephala uniseta* n. sp.: a, fifth sternum of male; b, male genitalia, lateral.

sternum with a rather shallow cleft on hind margin and shaped as in figure 122a.

Length: body, 4.0 mm.; wings, 3.8 mm.

FEMALE. Unknown.

Holotype male: 29 mi., Olaa, Hawaii, August 25 (no year given) (W. M. Giffard).

Type in B. P. Bishop Museum.

***Lispocephala waialealeae* Hardy, new species (figs. 123a-c)**

Fitting in the fasciculata group in the complex of species which lack posterior bristles on front tibiae and which have the antennae entirely yellow; also lacking fasciculae on male tarsi and the fifth sternum of male not projected. It fits near *uniseta* n. sp., from Hawaii, but differs by having the calypters pale yellowish-white and wings subhyaline; mesonotum and scutellum gray with no brown markings; tarsi yellow, faintly tinged with brown at apices; and fifth sternum and male genitalia entirely different in development (figs. 122a,b and 123a-c).

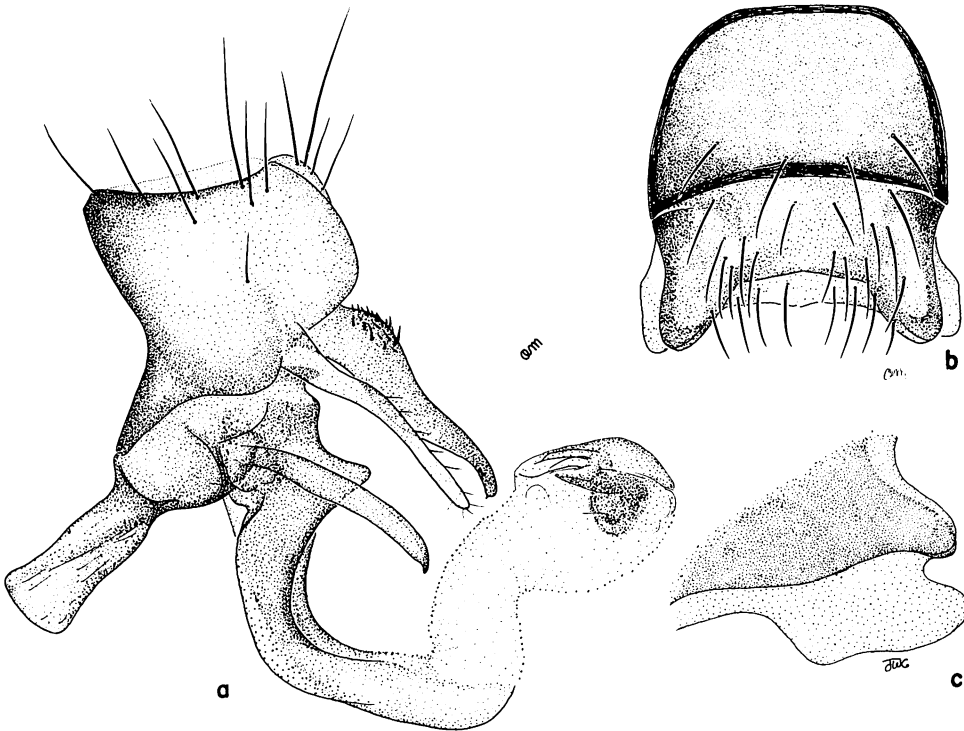


Figure 123—*Lispocephala waialealeae* n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral; c, fifth sternum, lateral.

MALE. *Head:* Broader than high with occiput, vertex, genae, face, frontal orbits, and ocellar triangle densely gray pollinose. Aristae yellow on the base, otherwise brown to black, short plumose on basal portion. Palpi slender, with three to four short black setae at apex and about three black setae on outside surface at middle of segment. Mouthparts yellow, tinged with rufous. *Thorax:* Black in ground color, densely covered with gray pollen. Apical scutellars small, scarcely over one-third as long as basal pair. Calypters pale yellowish-white, the upper extending two-thirds the length of the lower. *Legs:* Entirely yellow except for a tinge of brown on tarsi. Front tibia lacking a posterior bristle and middle tibia with a prominent posterior at the middle. Hind tibia with one prominent anteroventral at apical two-fifths. Hind femur with preapical anterodorsal and posterodorsals but no dorsals. Front basitarsus about half as long as tibia. *Wings:* Subhyaline. I see nothing distinctive about the venation. *Abdomen:* Dark brown to black, lightly gray pollinose, with sides of first four terga broadly yellow. The fifth sternum is slightly bilobate on each side (fig. 123c), with a shallow convexity in median portion as in figure 123b, no strong bristles are present on the sternum. The extension from the cercus is covered with short black setae on upper basal portion and the surstyli are very slender, slightly curved in median portion (fig. 123a).

Length: body, 3.5 mm.

FEMALE. Fitting the description of male in most respects; however, the pleura are mostly yellow, tinged with brown to black in ground color over the sternopleuron, onto the mesopleuron and the humeri, and sides of mesonotum are yellow in ground color.

Holotype male, allotype female, and two male paratypes: Mt. Waialeale Trail, Kauai, 4,500 ft., August 1953 (D. E. Hardy).

Type and allotype in B. P. Bishop Museum.

Subfamily STOMOXYINAE

Characterized by having the proboscis elongate, nonretractile, fitted for piercing skin and blood sucking. With the mentum at least as long as head and the labellae rudimentary but with conspicuous prestomal teeth. Also, the arista is pectinate, long rayed on upper side (fig. 124d), and in Hawaiian species only one sternopleural bristle is present.

For reviews of the subfamily refer to Malloch (1932), Van Emden (1965: 150), and to Zumpt (1973).

The larvae are dung feeders.

Two genera occur in Hawaii.

Genus **HAEMATOBIA** Lepeletier and Serville

Haematobia Lepeletier and Serville, 1828, in Latreille et al., Encyl. Meth. 10(2):499. Type-species, *Conops irritans* Linnaeus, by subsequent designation (Westwood 1840:140).

Lyperosia Rondani, 1856, Dipt. Ital. Prodr. 1:93. Type-species, *Conops irritans* Linnaeus, by original designation.

Siphona, authors, not Meigen.

For further synonymy refer to Zumpt (1973:71).

Differentiated by the elongate palpi, subequal in length to the proboscis, and two times longer than aristae (fig. 124d). Posterior margin of eyes not emarginate. Front of male narrow, at narrowest point only about equal in width to length of second antennal segment. Propleuron, notopleuron, and hypopleuron bare. Only anterior sternopleural bristle present, represented by yellow hair-like bristle. Bristles, hairs, and setae of pleura mostly yellow. Vein $R_4 + 5$ bare and costa setulose ventrally as far as vein R_1 .

Van Emden (1965:153, 168, 173) treats *Haematobia* and *Lyperosia* as distinct genera. Based upon *Stomoxys stimulans* Meigen "(fixation by Bezzi, 1911, disregarding ambiguous fixation by Westwood, 1840, as *irritans* L. . .)." This changes the concept of *Haematobia* completely and would be restricted to species having the arista haired both above and below, prosternum with black hairs on sides, and hind tarsi of male, simple. We are following the concept of Hockett, in Stone et al. (1965:869). The problem has been discussed in detail by Sabrosky (1971) and he has requested the International Commission on Zoological Nomenclature to place *Haematobia*, with *Conops irritans* as its type species, on the Official List of Generic Names.

Only one species in Hawaii.

***Haematobia irritans* (Linnaeus) (figs. 124a-e)**

The Horn Fly

Conops irritans Linnaeus, 1758, Syst. Nat. Ed. 10, Vol. 1:604. Type-locality: Sweden.

Lyperosia irritans var. *rufifrons* Bezzi, 1911, Archs. Parasit. 15:134. Type-localities: Hawaii, Michigan, and Texas.

For synonymy refer to Hockett, in Stone et al. (1965:914), and to Zumpt (1973:73).

Common on all the main islands in areas where cattle are present.

Immigrant. Widespread over Europe, North America and Canada, and the West Indies. First reported in Hawaii by Koebele, collected at Kaneohe Ranch, February 1898 (refer to Swezey 1931:360). Perkins (1913:clxxxvii) believed that it arrived about 1896. Van Dine and Norgaard (1908:25) said it was introduced with a shipment of cattle from the West Coast of the United States during 1897. It has been recorded and discussed many times in our literature under various combinations of *Lyperosia*, *Haematobia*, *irritans*, and *ser-rata*. It seems probable that this may have been introduced at a much earlier date, although it was not mentioned in literature until about 1886, but it is possible that they may have been introduced with the first cattle in 1793, by Vancouver (1798).

Biology and economic importance. This is the well-known horn fly, a serious pest of cattle and other domesticated and wild animals over Europe and America. Both sexes of the fly are blood suckers. They cause pain and annoyance to cattle; interfere with feeding and resting of the animals so that they

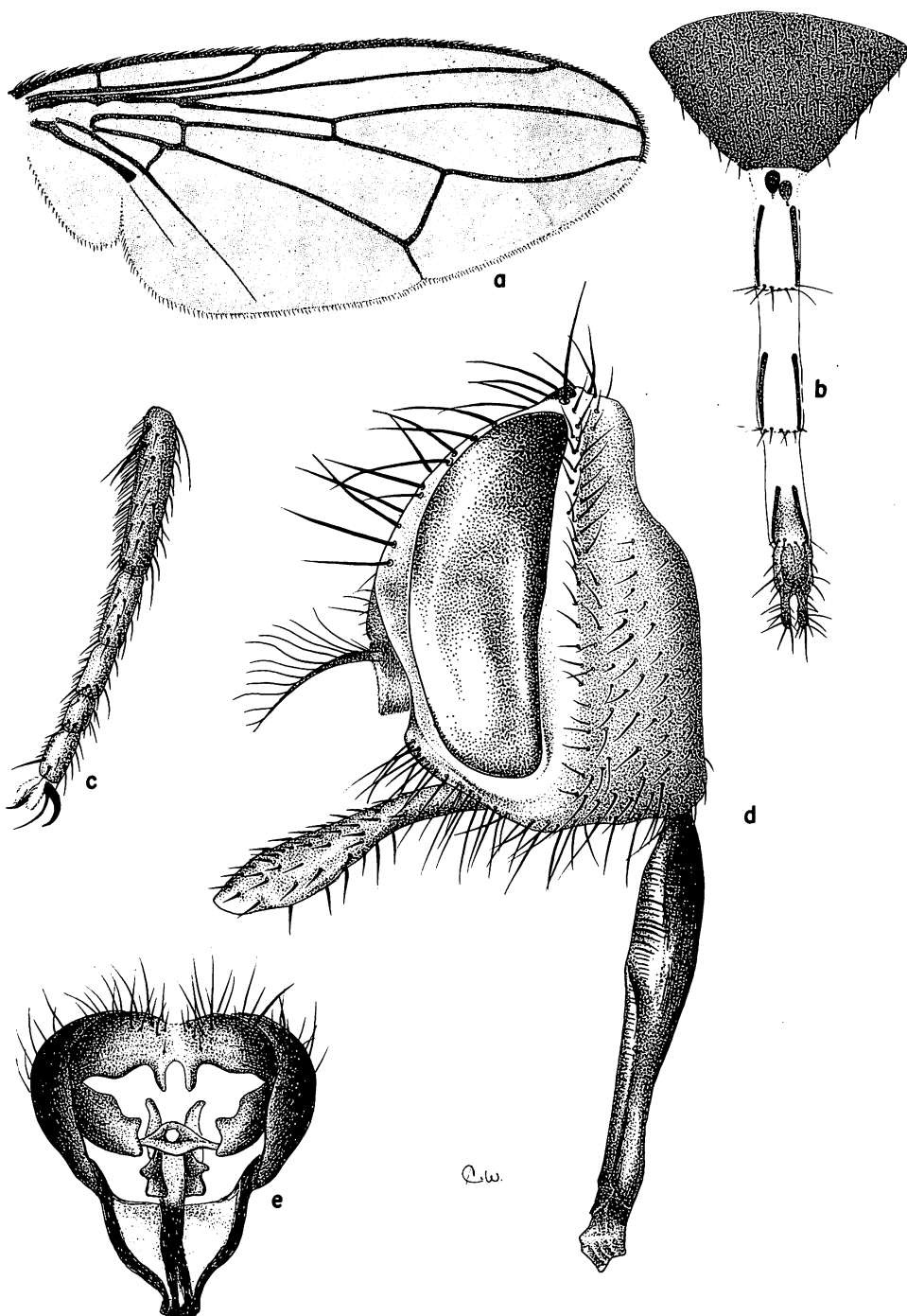


Figure 124—*Haematobia irritans* (Linnaeus): a, wing; b, post-abdomen of female, ventral; c, hind tarsus, lateral; d, head, lateral; e, male genitalia, end view.

lose weight, yield less milk, and suffer other disorders. McLintock and Depner (1954:20) say that damage and loss attributed to this fly "include loss in condition, reduction of one quarter to one half in milk yield, rubbing and licking themselves constantly to allay irritation of the bites. The loss of blood may be considerable when flies are abundant and has been estimated to be seven quarts per day, or 312 U.S. gallons per year from a heavily infested herd of 500 animals." James and Harwood (1969:276) say, "It is not uncommon, in areas where the horn fly abounds, for from 1,000 to 4,000 flies to be on one animal at any one time. Depner (personal communication) has observed numbers as high as 10,000 flies per animal in Southern Alberta and he states that claims as high as 20,000 per animal have been made."

Morris (1918) reported experimental transmission of anthrax by *H. irritans*, and Stirrat et al. (1955) found a wide assortment of bacteria associated with wild and laboratory-reared horn flies. They did no transmission studies, however, and concluded that the bacteria found on the bodies of the adults were obtained directly from their environment and that the normal internal bacteria are normal associates of cattle. Hibler (1966) reported that the horn fly is an intermediate host of *Stephanofilaria stilesi* (refer also to Ivashkin et al. 1963). This parasite is apparently common in cattle in Hawaii but the relationship of the flies to the disease has not been studied here.

The flies breed in fresh cattle manure. For a review of the life history and habits refer to Zumpt (1973:79-81) and to McLintock and Depner (1954), and for studies on the behavior refer to Hargett and Goulding (1962). For an annotated bibliography of the horn fly refer to Morgan and Thomas (1974).

Biological control. Several parasites have been reared from this fly in Hawaii or have been introduced in an attempt to control it: *Spalangia hirta* Halliday (Kotinsky 1906:31); *Eucolia impatiens* Say (Kotinsky 1907:83 and 1908:171); *Spalangia philippiensis* Fullaway (1917:292); *Spalangia cameroni* Perkins and *Spalangia* sp. (Timberlake 1924:426). The dung beetle, *Copris incertus prociduus* (Say), was introduced into Hawaii from Orizaba, Mexico, in 1923, by Osborn to aid in control of the horn fly (Fullaway and Krauss 1945:78). Davis and Krauss (1964:395-396) list five species of Scarabaeidae and two species of Histeridae, which have been purposely introduced for the biological control of this pest. Davis (1960:247) also listed a sixth species of scarabaeid dung beetle which has been introduced.

This fly rarely bites humans, only a few cases have been reported of it causing annoyance to people in Hawaii.

H. irritans is about half the size of *Stomoxys*, is the same general color, although more consistently gray, and is more slender bodied. It is readily separated by the generic characters given above. The characteristics of the head and mouth parts are as in figure 124d. According to Malloch (1932:504) this fits nearest to *exigua* de Meijere, from Indoaustralian and Oriental regions, also Micronesia. It differs by having the mesonotal bristles black or fuscous, rather than thoracic bristles all yellow or fulvous; palpi fuscous, rather than fulvous-yellow; basal-ventral bristle on hind femur strong, usually longer than diameter of femur, rather than being finer and shorter; middle femur of male

with several posteroventral bristles on basal third of segment which are more widely spaced and distinctly longer than those on anteroventral surface, rather than having posteroventral bristles on basal portion of femur, not much more widely spaced or longer than those on anteroventral surface. Also, the first three tarsomeres of the hind legs are apparently more distinctly lobate at apices and the second and third have fewer long cilia along posterior surface (fig. 124c, compare with figs. 17 and 18 of Malloch 1932:505). The genitalia of both sexes are as in figures 124b and e. Wings as in figure 124a.

Length: body and wings, 4.5–5.0 mm.

Zumpt (1973:75) placed the Hawaiian populations in the variety *rufifrons* Bezzi (1911:134), by having the body "less dark, grayish; bristles and hairs wholly or partly yellow, at least those on the mesopleuron; palpi yellow; proboscis and basal segments of antennae reddish or yellow; legs largely pale; wings hyaline, with yellow veins. Frontal stripe red or reddish; length 4–4.5 mm." He expressed the opinion that these color variations "are phenotypic, induced by environmental factors such as temperature and other microclimatic conditions which are not only apparent in different latitudes, but also in the same population at different times." Zumpt also said that the most reliable character for differentiating the subspecies *exigua* de Meijere from typical *irritans* is the arrangement of the bristles on the hind tarsi of the males. Snyder (1965:312) found this character inconstant in the specimens he studied from Micronesia. Zumpt concluded that Snyder's findings "may perhaps be explained by interbreeding of *exigua* from the Oriental region with those from the Nearctic and Hawaiian regions."

Genus **STOMOXYS** Geoffroy

Stomoxys Geoffroy, 1762, Hist. abrég. des Insectes 2:449, 538. Type-species, *Conops calcitrans* Linnaeus, subsequent designation (I. C. Z. N. 1957:85).

Differentiated by having the palpi short, about one-fourth as long as the proboscis and shorter than the arista (fig. 125b). Also by having the eyes strongly emarginate posteriorly. Eyes of the male widely separated on the front. Dorsocentral bristles very short, only the posterior pair well defined. Propleuron and upper hypopleuron setose, also with setae on notopleuron around bases of bristles. Only the posterior sternopleural bristle present. Vein $R_4 + 5$ setose on node and along vein before r-m crossvein and costa bare ventrally.

Only one species in Hawaii.

Stomoxys calcitrans (Linnaeus) (figs. 125a–d)

The Stable Fly

Conops calcitrans Linnaeus, 1758, Syst. Nat. Ed. 10, Vol. 1:604. Type-locality: Sweden.

For synonymy refer to Hockett, in Stone et al. (1965:914) and to Zumpt (1973:101).

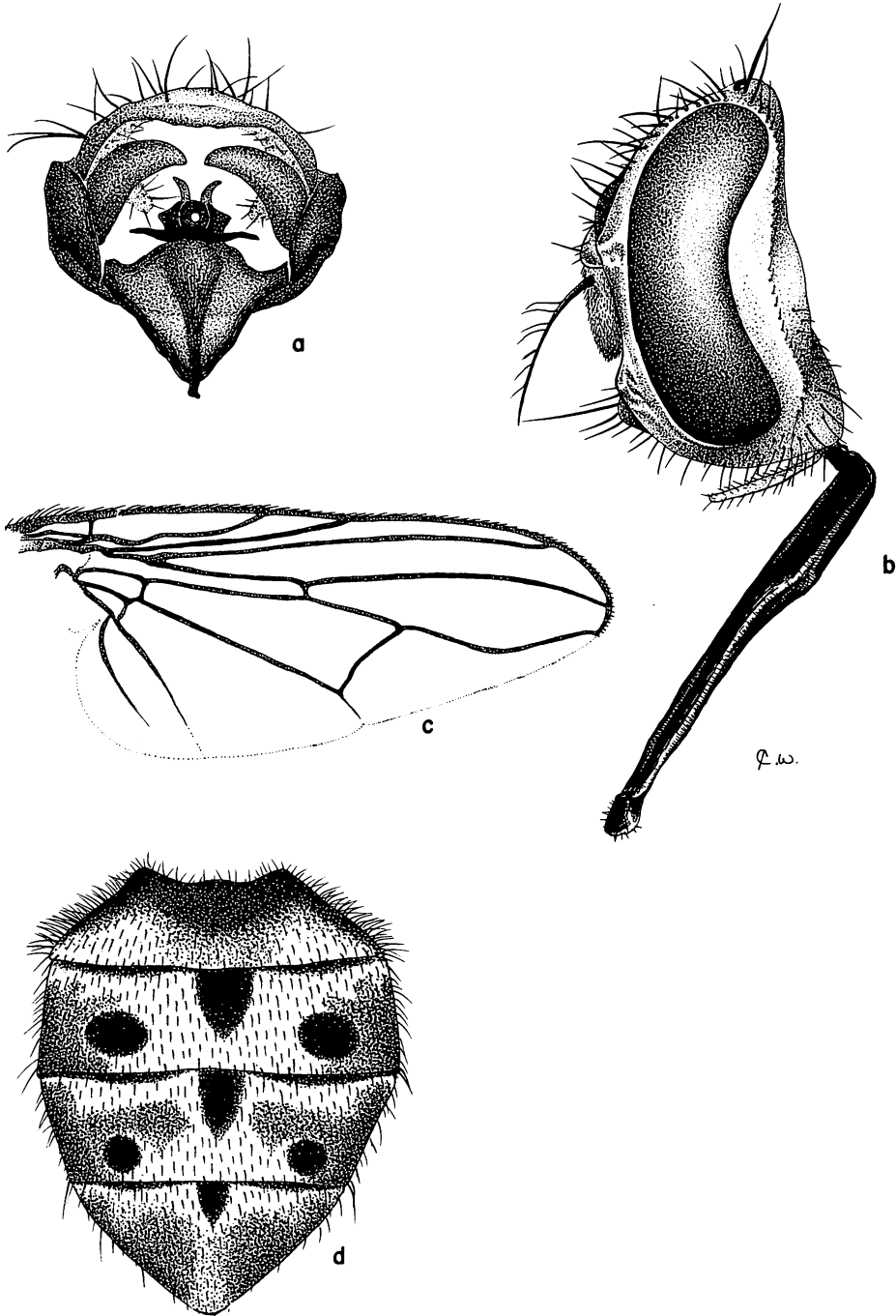


Figure 125—*Stomoxys calcitrans* (Linnaeus): a, male genitalia, end view; b, head, lateral; c, wing; d, abdomen, dorsal.

Widespread over the Hawaiian Islands. First reported by Howard (1901) and Grimshaw (1901:28). The earliest collection records date to 1892 (Perkins 1913:clxxxvii). As discussed under *Haematobia irritans*, it seems possible that this species could also have arrived with the first cattle in 1793.

Immigrant. Cosmopolitan.

Biology and economic importance. This fly breeds commonly in a wide assortment of decaying organic matter from dung to rotting vegetation, including seaweed along the beaches. It is an important pest of livestock and does frequently bite people, especially in heavy shade or when the sky is overcast. It is a vicious biter and is very irritating, causing a stinging sensation and considerable annoyance to animals. The flies attack principally the legs; however, when abundant they attack any part of the body. Because of their similar size and appearance with that of the house fly, laymen commonly believe that house flies bite just before it is getting ready to rain. An excellent review of the biology of this species is presented by James and Harwood (1969:273), also by Zumpt (1973:105-107). For biological data and control methods, refer to U.S.D.A. leaflet No. 338, 1953 and to Zumpt (1973:145-152). Freeborn et al. (1925) demonstrated that stable flies cause a marked drop in milk production in dairy animals, amounting to 9.26 percent loss, which in over a five month period amounted to a loss of 50 gallons of milk per lactating animal. It has been demonstrated that this fly is of considerable importance in the transmission of several pathogens of horses and other animals such as the virus of infectious anemia of horses, the anthrax bacillus, the spirurid worm *Habronema microstoma* (Schneider), and several trypanosomes, including the causative organism of surra (*Trypanosoma evansi*). Refer to James and Harwood (1969:275). Zumpt (1965:35) reports two cases of intestinal myiasis in man and one case of traumatic myiasis in man and one in animals from the literature but concludes that "all these cases are not convincing and it is hardly to be expected that *S. calcitrans* plays a role as a myiasis producer." James, however, (1947:133) said it would seem "that this species may, on rare occasions, produce both gastric and traumatic myiasis." As the cause of pathological reactions and transmitters of pathogenic organisms, refer to Zumpt (1973:138-145).

Parasites: *Spalangia cameroni* Perkins has been recorded from all the major islands (Timberlake 1924:426). According to Bohart and Gressitt (1951:117), *Spalangia muscidarum* Richardson is a frequent pupal parasite of this fly on Guam. For natural enemies and biological control studies refer to Legner et al. (1966) and Legner and Olton (1968).

Mostly gray bodied, about the same size and general appearance as the house fly. With four brown longitudinal vittae down mesonotum and with brown spots on abdominal terga; terga 3 and 4 each have a basal median brown spot and two dorsolateral brown spots just before apex. The fifth tergum has a small mediobasal brown spot (fig. 125d). The legs are mostly black, the tibiae are yellowish basally. Vein R with about four erect setae on node just before radial sector on dorsal surface and vein $R_4 + 5$ with prominent, erect

setae above, extending from node about halfway to r-m crossvein. Also with a few setae below on basal portion of vein. Wing venation as in figure 125c. According to Malloch (1932:403), "The most reliable characters for the recognition of the species are as follows: Frons of the male about one-fourth of the head-width, that of the female wider, in both sexes with yellowish or whitish dusted ocellar triangle extending well beyond middle when seen from the side; legs black, bases of tibiae testaceous, the hind femora with some short setulae on the median portion of the anteroventral surface, which are noticeably stronger and more erect than the hairs on anterior surface, the posteroventral surface without distinct bristles; hind tibiae stouter than usual, with four or more short anteroventral setulae and the anterodorsal series of setulae on the entire extent better developed than usual, generally as strong as the anteroventral setulae." Male genitalia as in figure 125a.

Length: body, averages 6.0–6.5 mm.

Superfamily CALLIPHOROIDEA

Family CALLIPHORIDAE

The Blow Flies

These are the bluebottle, greenbottle, or blow flies which are abundant over much of the world and are familiar to everyone. These are mostly metallic blue, green, bronze, or black flies, differentiated from Muscidae by the distinct row of hypopleural bristles and from the Tachinidae by the wanting, or only weakly developed postscutellum. They are differentiated from Sarcophagidae by the predominantly metallic body; the area behind eye before the postocular row of setae with fine hairs except in Rhiniinae; outer posthumeral bristle, when present, laterad of the presutural; only two notopleural bristles present; propleuron and prosternum pilose, except in Polleniinae; arista usually long plumose with the rays extending nearly to apex. Alphasetae (a pair of minute, transparent setae at anterior margin of sterna 2–5) present (Downes 1955). Posterior spiracles of larvae not in a deep concavity, the peritreme is usually closed and the "button" usually distinct. The dorsal cornua of the cephalopharyngeal skeleton is not divided or incised.

The adults are strongly attracted to moisture, they are found commonly feeding at flowers, on honeydew, and on any sweet liquids, also on the liquid products of organic decomposition; the last type of food is probably essential for providing the proteins needed for egg maturation. The species of the subfamilies Calliphorinae and Chrysomyinae are predominantly scavengers and breed especially in carrion. Because of their predilection for inhabiting filth and any kind of rotting organic matter many of the species are of considerable importance as transmitters of human pathogens, especially those which can be spread by contamination (refer to Lindsay and Scudder 1956; Hall 1948:10). Some species are obligatory parasites and many are facultative parasites of higher animals and may be positive agents in many kinds of myiasis (refer to James 1947; Zumpt 1951 and 1965; Greenberg 1971). The losses to the live-

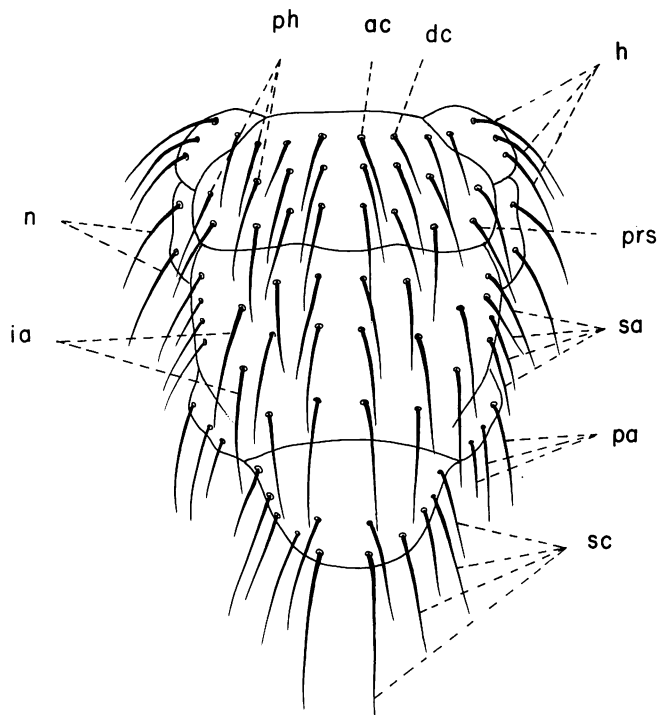


Figure 126—Dorsal view of thorax of a calliphorid, showing the major bristles: *ac*, acrostichals; *dc*, dorso-centrals; *h*, humerals; *ia*, intraalars; *n*, notopleurals; *pa*, postalars; *ph*, posthumerals; *prs*, presuturals; *sa*, supraalars; *sc*, scutellars.

stock industry alone amount to millions of dollars a year (refer to Laake 1936; Hall 1948:14; James 1948:65; Colless and McAlpine 1970:735).

The species of Polleniinae are parasites of earthworms and the Rhiniinae are evidently predators or parasites of termites, Hymenoptera, Orthoptera, and possibly other insects. The early literature concerning blow flies in Hawaii contained considerable confusion. Norgaard (1906) recorded the American screw-worm fly (as *Comptosmyia macellaria* Fabr.) on Molokai in 1905 and said he had seen several hundreds of cases of it in sheep. Van Dine and Norgaard (1908:61) said that the screw-worm fly had almost disappeared in Hawaii probably as a result of the effect of natural enemies of the fly present in Hawaii. I do not believe that the screw-worm was ever established here, there are no specimens in the old collections. Van Dine and Norgaard (1908) and Van Dine (1909) gave detailed accounts of *Chrysomya megacephala* (Fabr.) (as *dux*) being a serious parasite of sheep and referred to it as the "Hawaiian sheep maggot fly." It is probable that they were confusing this with species of *Phaenicia* or with *Chrysomya rufifacies* (Macquart) (refer to discussion under that species).

Another remarkable case of unusual and, based on island ages determined by geologists, recent, adaptive radiation in Hawaiian insects is exemplified by the female reproductive system in the endemic calliphorid genus *Dyscritomyia* Grimshaw. The ovaries of females of the typical Calliphoridae have large numbers of ovarioles, and eggs are deposited in batches wherever suitable media are found. In *Dyscritomyia*, each ovary is reduced to two ovarioles, only one egg is produced at a time and this is retained in the uterus through two full instars. Apparently there is no adaptation for adenotrophic viviparity, no milk glands are developed, and the eggs are unusually large, 2.0 mm. or more, depending upon the size of the species, and contain enough yolk material to provide larval nutrition through two instars. The reproductive system has been studied by Pollock (1974) and comparisons made with that of the tsetse fly (*Glossina*).

The biologies of the *Dyscritomyia* are still much of a mystery. Some circumstantial evidence at hand would indicate that they are probably associated with endemic land and tree snails, and some are obviously scavengers on other insects and possibly dead birds. Dr. Pollock has suggested, *in litt.*, that from the nature of the mouth hooks it would appear that the third stage larvae may be parasitic and this would seem to be confirmed by a few bits of information in the literature. Terry (1912) in 1910, reported rearing a specimen of *Dyscritomyia* (probably *fasciata* [Grimshaw] or *divisa* James, n. sp.) "from living land shells, probably *Achatinella lymaniana* Bald."

Perkins (1907:98), in a discussion of insects in the Kilauea area, Hawaii, said:

Most conspicuous are the Sarcophagid [*sic*] flies of the genus *Dyscritomyia* and *Prostethochaeta*. They may be seen buzzing round the herbage or shrubs in a very Tachina-like manner and in fact often in company with these parasites. Their habits are yet unknown. I had long supposed them to be parasitic on cutworms, but the discovery by Mr. Terry, that they produce living maggots of large size, makes this supposition less probable. The fact that they often frequent the driest and most arid localities, where there is little or no decaying vegetable matter, and that, in other places where such matter exists, one does not find fly maggots therein, that could produce these large species, the further fact that animal matter under natural conditions in the islands was necessarily almost wanting, there being only birds to supply this, makes the problem a puzzling one. In spite of this, the species of these flies are numerous, the individuals sometimes abundant, so much so as to furnish the food supply for the larvae of various Hawaiian Crabronidae.

In the introduction to the Fauna Hawaiiensis, Perkins (1913:clxxxvi) indicated that they are probably scavengers on Mollusca. He said Mr. Terry reared one of these maggots to maturity on a mixed animal diet, including land molluscs. He later reared them in a glass jar containing living and dead molluscs. He also said that many shell collectors have observed maggots in shells, found still fresh but not living and that he himself would sometimes find

a number of shells infested with maggots in a single day in the field. Perkins made his observations in the 1890s, during the period of Hawaiian history when the land snails were one of the most abundant forms of invertebrates in the forests. He said (*lot. cit.*):

When one considers the great numbers of mollusca that exist in limited areas in the islands, it is certain that, even in a small area, many individuals must be dying each day of the year, quite sufficient to supply food enough to support the number of existing flies, especially as these when adult are very long-lived. Considering the well-known and very strong odour of dead land molluscs, these would not fail to readily attract creatures so keen-scented as Sarcophagous [*sic*] flies, probably long before the odour became appreciable to human senses. No doubt many kinds of molluscs serve as food for the maggots, for the flies are common enough in localities where only the thin-shelled *Succinea* is to be found. Species of this genus are to be found in very dry localities, and would account for the presence of flies in such places.

Dr. Swezey (1914) reared three specimens of *Dyscritomyia* sp. "from maggots which emerged from a snail (*Achatinella curta*) collected up the Opaepala Gulch," Oahu. It was not indicated whether the snail was dead or alive when he collected it.

We have not been successful in verifying this and have never been able to find snails infested with *Dyscritomyia* larvae. Numerous attempts have been made by the writer and his graduate students to find larvae in living or dead snails with no success. Adults are often attracted to dead snails but we have, so far, obtained no results by caging flies with living or dead snails. Also in the 31 years that I have been in Hawaii I have not heard of any parasitized snails being reported by any of the snail collectors. It is also interesting to note that not a single *Dyscritomyia* was reared from the extensive sampling of litter which was carried out over a full year's time on the slopes of Mauna Loa, Hawaii, where the adult flies are common, as part of the International Biology Program Hawaiian study.

The adults are attracted to a wide assortment of decaying animal materials for feeding. They have been observed feeding on feces of pig, rodent, humans, and birds, upon dead earthworms, dead Isopoda and dead snails. They have also been attracted to brewers yeast baits, to rotting meat and to Danish cheese. Mr. S. L. Montgomery has observed adults feeding on freshly smashed lepidoptera larvae, also adults of *D. obscura* Grimshaw feeding on lepidoptera larvae in bird droppings and has seen *D. fasciata* (Grimshaw) feeding at a slime flux on an *Osmanthus* tree. At Kilauea, Hawaii, females of *fasciata* were attracted to fresh pig liver but no larvae were found. Dr. F. G. Howarth collected adults of *grimshawi* James, n. sp., feeding on dead earthworms on trail from Paliku cabin, Haleakala Crater, but no larviposition was observed.

We have only sketchy information as to the feeding habits of the free-living third instar larvae. The circumstantial evidence at hand would indicate that

most species are probably scavengers in bodies of other insects, birds, possibly snails and other organic matter. Mr. Montgomery has reared three specimens of *D. grimshawi* James, n. sp., along with 50-75 specimens of *Eucalliphora lilaea* (Walker), from the carcass of an endemic bird, apapane. He also has reared this species on the bodies of *Dyscritomyia* and *Drosophila* adults and from protein hydrolysate. Approximately three weeks were required for development from second instar larva to the adult. In one experiment in the summit cloud forest of Lanai, he exposed freshly torn bodies of sphinx moths, *Herse cingulata* (Fab.). Four specimens of *D. hawaiiensis* Grimshaw were attracted and fed upon the body fluids. Two maggots were deposited, and the moth bodies were removed to a rearing chamber in the laboratory until the adults emerged. On another occasion he attracted females of *lucilioides* (Grimshaw) to freshly cut tipulid larvae but no larvae were recovered. On the island of Hawaii Mr. Montgomery reared *D. lucilioides* (Grimshaw) from larvae found in the leaf axils of *Freycinetia* plants. In this case the source of nutrition was uncertain but may have been the drosophilid or chironomid larvae which were breeding in the spikes of the *Freycinetia*. Dr. H. Kurahashi, Tokyo, Japan, said (*in litt.*) that while doing some field work on Oahu he reared a *Dyscritomyia* on a piece of cheese.

When captured, the gravid females frequently deposit their larvae inside the killing or holding bottles. On several occasions larvae have completed their development and pupated in our food vials (sweetened agar soaked into blotting paper) which we use for *Drosophila*. One specimen partially emerged. These were undersized, malnourished pupae; the larvae apparently did some feeding on the agar but the necessary nutrients for normal development were lacking. The third instar probably needs only one good meal in order to complete its development.

Dyscritomyia are found commonly in the rain forests in situations where snails are found on the vegetation as well as in the litter on the ground. The flies are most abundant and active in bright sunshine and are seen alighting on fern fronds and other low vegetation in the forest.

Some species (*hawaiiensis* Grimshaw, *grimshawi* James, n. sp., *robusta* Grimshaw, et al.) frequent the ground and prefer alighting on ground litter rather than on vegetation. Some species occur fairly abundantly in relatively dry areas, that is, on the slopes of Mauna Loa, Hawaii, to an elevation of 8,000 ft. and Haleakala Crater, Maui, 6,500-7,000 ft., where there seems to be no evidence of snails whatsoever. It surely appears from the observations made to date that the ground frequenting species are probably scavengers on an assortment of rotting animal materials, particularly earthworms. It would also appear logical that the foliage frequenting species may be parasites of snails or possibly other insects.

Snails would surely appear to be the logical hosts for a parasite the size of *Dyscritomyia*. The next most logical candidate would appear to be lepidoptera larvae. If the latter were parasitized, however, it surely would have come to the attention of Dr. O. H. Swezey (and others), who spent his lifetime studying insects of the native forests in Hawaii (Swezey 1954). Also, nestling birds

have been considered as a possibility but over the years the ornithologists have never reported evidence of parasitism.

Larviparity, at an advanced stage involving retention of the maggots in the female uterus through at least two instars, has evolved several times in unrelated groups of Muscoidea. The best known examples are the Glossinidae and the "pupiparous" Diptera Hippoboscidae, Nycteribiidae, and Streblidae. These are haematophagous and have acquired adenotrophic viviparity, so the larva is retained in the uterus until mature, there is no free living larval stage. In the family Calliphoridae (*sens. lat.*), at least four distinct evolutionary lines over the world are known to be macrolarviparous: the Mesembiniinae, Neotropical Region (recently raised to family rank by Guimaraes, in press); the Ameniinae and Phumosiinae, Oriental and Australasian regions (Crosskey 1965, 1969; Ferrar 1967, 1978; James 1969:251); and *Dyscritomyia* (Calliphorinae, Luciliini) in Hawaii. These are all known to be associated with snails, either as parasites or predators (the associations have, however, not clearly been worked out). As pointed out by Keilin (1919) and Ito (1962), some species of *Melinda* Robineau-Desvoidy (Calliphorinae and Calliphorini) are parasites of land snails. Keilin describes the European species as oviparous, and Kurahashi (1970:525) indicates the Japanese species is viviparous but this deposits first instar larvae and has the reproductive system quite different in development.

The evidence is suggestive that there is a convergence in various groups which are associated with molluscs to develop the macrolarviparous habit and Dr. J. H. Guimaraes (zoological Museum, Univ. São Paulo), *in litt.*, has suggested that this may be an adaptation for living in special environments, such as dead molluscs, where the food materials are scarce and of fast decomposition. Since the land snails are comparatively small animals, a fly that deposits one advanced-stage larva at a time would be much better adapted to utilizing this medium as a food source than would be one which lays large numbers of eggs, as do most calliphorids.

Dyscritomyia are commonly preyed upon by crabronid wasps (refer to Williams 1927:444-445; Perkins 1907:98).

The taxonomic writeup on the *Dyscritomyia* has been prepared by Dr. M. T. James, Washington State University.

KEY TO GENERA AND SPECIES OF HAWAIIAN CALLIPHORIDAE

1. Basal portion of radius ciliated posteriorly above
(figs. 157d and 161a) 2
Base of radius bare. 5
- 2(1). Occiput concave, with the occipital orbits very narrow and lacking cilia, except for the occipital row.
Epistoma strongly protuberant (fig. 161e). Rather small flies (body, ca. 6.0 mm.) with abdomen

- and legs mostly rufous. Rhiniinae
- **Rhinia** Robineau-Desvoidy
apicalis (Wied.).
- Occiput flat, orbits comparatively broad and covered with fine hair; epistoma not protuberant (fig. 160a). Large metallic blue-green flies (body, 7.0–11.0 mm.). Chrysomyinae 3
- 3(2). Lower calypter (squama) densely pilose above (fig. 157a). Prealar callus with dense erect hairs. Chrysomyini. **Chrysomya** Robineau-Desvoidy 4
- Lower calypter bare above. Prealar callus bare except for short pubescence. Phormiini
- **Phormia** Robineau-Desvoidy
regina (Meigen).
- 4(3). Mesothoracic spiracles dark brown. Genae orange, covered with yellowish hairs
- **megacephala** (Fabricius).
- Mesothoracic spiracles white. Genae reddish brown to blackish with the ground color obscured by dense gray pollen, white pilose
- **rufifacies** (Macquart).
- 5(1). Propleura and prosternum hairy. Parafacials bare at least on lower half (figs. 129a and 130a). Thorax not with golden crinkly hair. Calliphorinae 6
- Propleura and prosternum bare. Parafacials densely setose to below eye margin (fig. 160a). Thorax densely covered with golden crinkly hair. Dull black, nonmetallic, thinly silvery pollinose species. Polleniinae. *Pollenia* R. D.
- **rudis** Robineau-Desvoidy
- 6(5). Lower calypter pilose above (fig. 129c). Parafacials setose on upper portion. Calliphorini 7
- Lower calypter bare above (fig. 154a). Parafacials bare. Luciliini; or with about four inconspicuous hairs on upper portion continuous with a line of hairs from parafrontalia. = Calliphorini, in part (*Melinda* Robineau-Desvoidy). 10
- 7(6). Sides of facialia with strong ascending bristles (fig. 130a). A pair of strong bristles immediately above posterior ocelli. **Eucalliphora** Townsend.
lilaea (Walker).
- Facialia with black setae but not with strong ascending bristles. Accessory ocellar bristles lacking 8

- 8(7). Presutural intraalar bristles present. **Calliphora**
Robineau-Desvoidy 9
Presutural intraalars absent. Male genitalia as in
figure 127b **Aldrichina** Townsend.
grahami (Aldrich).
- 9(8). Bucca entirely black, hairs on posterior portion
yellow to orange. Basicosta dark brown to black.
Mesothoracic spiracle dirty blackish to brownish
yellow. On all the main islands at higher eleva-
tions **vomitioria** (Linnaeus).
Anterior two-thirds of bucca yellow to yellow-
orange, hairs on posterobasal portion mostly
brown to black. Basicosta yellow-orange and
mesothoracic spiracle yellow. Oahu
. **vicina** (Robineau-Desvoidy).
- 10(6). Body mostly metallic, at least on abdomen, blue,
purple, green, coppery or black. Posterior part of
suprasquamal ridge with a tuft of black erect hairs
(fig. 154a). Lucilini 11
Nonmetallic flies, thorax mostly gray pollinose,
apex of scutellum yellow and abdomen rufous ex-
cept for a narrow black median vitta extending
longitudinally over terga 1-4 and with basal 2/3
of fifth tergum black. Posterior parasquamal tuft
absent. Calliphorini, in part
. *Melinda* Robineau-Desvoidy.
pusilla (Villeneuve).
- 11(10). Male cerci strongly lobate, just one pair of lobes
(surstyli) on epandrium (fig. 156c). Abdominal
terga not conspicuously bristly, lacking dorsome-
dian (discal) bristles on terga. 12
Cerci not lobate; two pairs of strong lobes on epan-
drium (figs. 132c and 134e). Males with strong
dorsomedian (discal), as well as posterior bristles
on terga 2-5 (fig. 149e); females usually as above,
or in some species lacking the discals on tergum 3
and sometimes 4. *D. alta* n. sp. is aberrant and
lacks discals in both sexes. Endemic
. **Dyscritomyia** Grimshaw.
- 12(11). Subcostal sclerite bare. Frons of male usually com-
paratively broad—17-20 rows of facets. Metallic
blue-green or coppery species. Only lower mar-

- gins of facialia with setae. **Phaenicia** Robineau-Desvoidy 13
- Subcostal sclerite (basal portion of subcostal vein on underside of wing) with hairs. Frons of male very narrow, equal in width to only 3 rows of eye facets. Shining black species. Facialia with a row of short setae on lower one-half to two-thirds. Laysan and Midway Islands.
- **Lucilia** Robineau-Desvoidy.
- **graphita** Shan.
- 13(12). Metasternum bare. Male with a pair of strong bristles immediately above the posterior ocelli. Frons of male broader than in *sericata* (Meigen), about equal in width to 20 rows of eye facets or about one-fifth head width. Abdominal sterna and sides of terga long haired (fig. 155a). Lobes of cerci slender, parallel-sided on apical halves. Genae of female less than one-third eye height.
- **cuprina** (Wiedemann).
- Metasternum setose. Male lacking secondary ocellar bristles or, if rarely a pair is present, they are scarcely larger or stronger than the abundant erect postocellar hairs. Frons comparatively narrow, equal in width to 17 eye facets and about one-eighth head width. Under part of abdomen with ordinary hairs, fourth sternum with evenly scattered setae over entire sclerite (fig. 156a). Lobes of cerci gradually tapered to apices. Genae of female broad, nearly two-fifths eye height
- **sericata** (Meigen).

Subfamily CALLIPHORINAE

The typical blow flies, bluebottle or greenbottle flies, belong to this subfamily. They are characterized by having the base of radius bare above; the propleuron and prosternum setose; the parafacialia bare on lower third or more and the thorax lacking crinkly hair. "Third instar larva with closed, strongly sclerotized, peritreme" (Hall 1948:44).

Two tribes are present in Hawaii.

Tribe CALLIPHORINI

Hall (1948:203) characterizes members of this tribe as having "lower squamal lobe pilose above; parafacialia usually partially setose; parasquamal

tuft absent; arista with or without cilia apically. Larva with accessory oral sclerite between labial sclerites."

Four genera are present.

For a review of the tribe Calliphorini from the Australian and Oriental regions (and including Hawaii), refer to Kurahashi (1970 and 1971).

Genus **ALDRICHINA** Townsend

Aldrichiella Rohdendorf, 1931, Zool. Anz. 95:177 (preocc. Vaughan 1903).

Type-species, *Calliphora grahami* Aldrich, by original designation.

Aldrichina Townsend, 1934, Rev. de Ent. 4:111. New name for *Aldrichiella* Rohdendorf.

This fits near *Calliphora* Robineau-Desvoidy and is differentiated by lacking presutural intraalar bristles and having the male cerci slender, strongly curved upward, as seen in lateral view (fig. 127b).

A monotypic genus.

Aldrichina grahami (Aldrich) (figs. 127a,b)

Calliphora grahami Aldrich, 1930, Proc. U. S. Nat. Mus. 78(1):1.

Oahu. Known from only two specimens taken in a mosquito light trap on Sand Island, Oahu, May 1962 (Joyce 1963).

Immigrant. Not known to be established in Hawaii. Widespread over western U.S., China (Szechuan Province), Siberia, Japan, Korea, Taiwan,

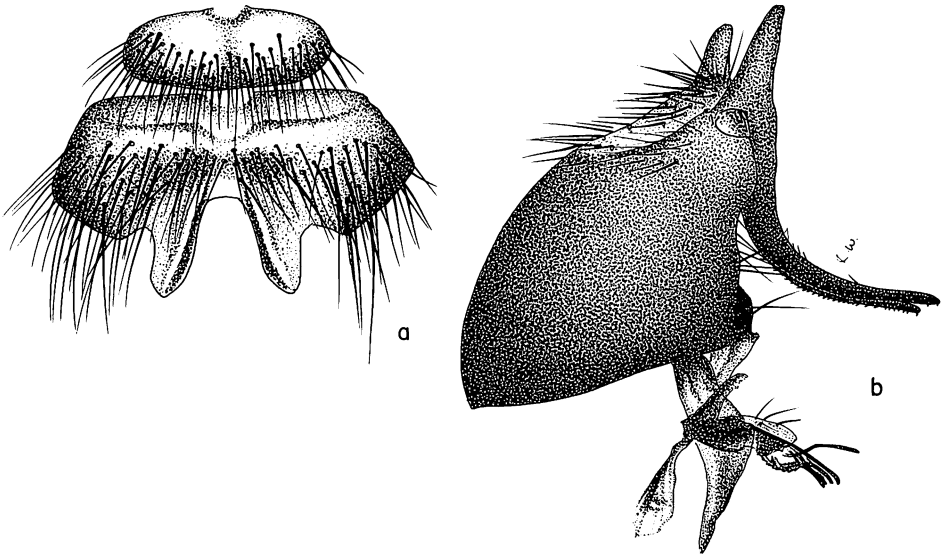


Figure 127—*Aldrichina grahami* (Aldrich): a, fifth sternum of male, ventral; b, male genitalia, lateral.

Pakistan, and India. Indigenous to Asia and evidently imported into the western U.S. in recent years.

Bionomics. Breeds in a wide assortment of decaying organic matter.

A large species closely resembling *Calliphora vomitoria* and differentiated by lacking the presutural intraalar bristle; frons of male comparatively broad, two times wider than ocellar triangle, about one-fourth as wide as one eye and equal to the length of 19 to 20 rows of eye facets; also the dark metallic blue of the abdomen is largely obscured by silvery pollen on the first four terga. The male genitalia are very characteristic as shown in figure 127b. The fifth sternum of male is as in figure 127a.

Length: body, 8.0–12 mm.

For more detailed descriptions refer to Hall (1948:290) and to Kano and Shinonaga (1968:22).

Genus **CALLIPHORA** Robineau-Desvoidy

Calliphora Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2)2:433. Type-species, *Musca vomitoria* Linnaeus, by original designation.

These are the well-known, large blow flies or bluebottle flies over much of the world. The thorax is dull black, lightly gray pollinose and the abdomen typically dark blue. They are characterized by having the base of radius bare; propleura, prosternum, and upper surface of lower calypter haired (fig. 129c); parafacials bare on lower half; facialia with moderately small black setae on sides and no accessory ocellar bristles. In the typical subgenus, the eyes are bare and the frons of the male comparatively narrow.

For more detailed discussions of the generic characters refer to Hall (1948:292) and to Kurahashi (1971:162).

Two species have been recorded in Hawaii. For an excellent treatment of the postabdomen of the male refer to Salzer (1968).

Calliphora vicina Robineau-Desvoidy (figs. 128a,b)

The European Bluebottle Fly

Calliphora vicina Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2)2:435.

For synonymy refer to Hall, in Stone et al. (1965:929).

Oahu. Apparently rare, possibly not established. Known only from seven specimens collected by Dr. C. R. Joyce in Honolulu, June 1947; September 1948; June 1957; April 1959; November 1961; and March 1968. Refer to Joyce (1950 and 1958).

Immigrant. Nearctic, Neotropical, Holarctic, southern Africa, and southern Australia.

Bionomics. Normally a carrion breeder but in other areas has been reported on several occasions causing traumatic myiasis of man and other animals (refer to James 1948:91 and Zumpt 1965:59).

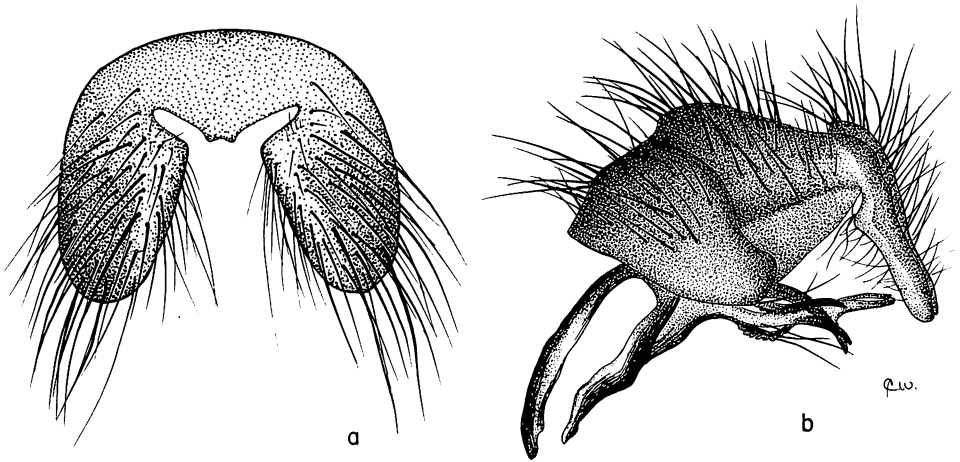


Figure 128—*Calliphora vicina* Robineau-Desvoidy: a, fifth sternum of male, ventral; b, male genitalia, lateral.

This species resembles *vomitioria* (Linnaeus) but differs by having the genae largely yellow to orange, black only on posterior portion and with dark brown to black hair; the mesothoracic spiracle yellow and the basicosta yellow-orange; male frons broader, slightly wider than ocellar triangle, about 0.10 head width and equal to length of 10 to 11 rows of eye facets and male surstyli scarcely tapered, rather broad and blunt apically (fig. 128b); the fifth sternum is as in figure 128a.

Length: body, 6.0–12.0 mm.

For a detailed description refer to Hall (1948:307–313).

***Calliphora vomitoria* (Linnaeus) (figs. 129a–d)**

Musca vomitoria Linnaeus, 1758, Syst. Nat. ed. 10, vol. 1:595.

Musca obscoena Eschscholz, 1823, Naturw. Abhandl. aus Dorpat. 1:113.

Calliphora rubrifrons Townsend, 1908, Smithsn. Inst., Smithsn. Misc. Collect. 51(2):116.

Common on all of the main islands at higher elevations from 4,000–10,000 ft. Specimens have been collected on Mauna Kea, Hawaii, at 13,784 ft. (Swezey and Williams 1932).

Immigrant. Widespread over the Palearctic, Oriental, and Nearctic regions, also South Africa.

Bionomics. Breeds in carrion and other rotting organic matter. In Hawaii, this fly, also probably *Eucalliphora lilaea* (Walker), is probably closely associated with the populations of wild goats which occur in the mountains throughout the Islands; it is abundant in areas populated by goats. The larvae have been reported on several occasions causing sheep strike in Great Britain and in Tripoli but only as secondary or tertiary invaders (Zumpt 1965:61). Zumpt points out that since this fly commonly oviposits on meat, “the larvae may

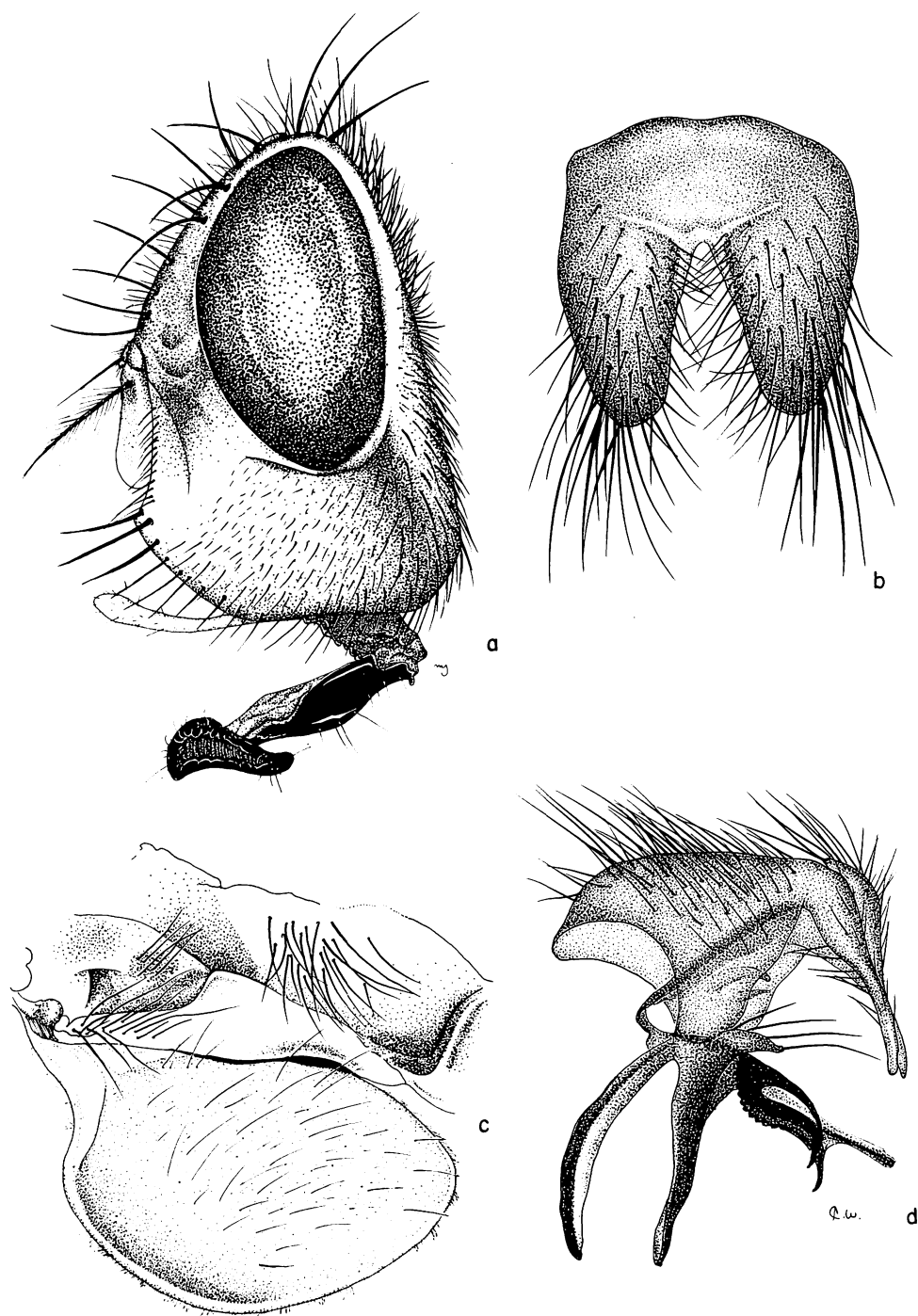


Figure 129—*Calliphora vomitoria* (Linnaeus): a, head, lateral; b, fifth sternum of male, ventral; c, calypter and suprasquamal area; d, male genitalia, lateral.

easily be swallowed with food and reappear in the stool, giving the impression of causing an intestinal myiasis. Cases of true intestinal myiasis due to these flies have not yet been confirmed beyond any doubt, and corresponding reports may all be labeled as pseudomyiasis."

This fly, along with *C. vicina* Robineau-Desvoidy, is the largest of the calliphorids in Hawaii and resembles the larger specimens of *Eucalliphora lilaea* (Walker) by the dull black, lightly gray pollinose thorax and the dark blue abdomen. It is differentiated by the generic characters given above. It is distinguished from other species of *Calliphora* by having the bucca entirely black with reddish orange to yellowish hair, which is most abundant posteriorly, and the basicosta black, in combination with having the frons of male at narrowest point less than width of ocellar triangle and equal to only about 6-7 rows of eye facets. The head is as in figure 129a; the fifth sternum of male as in figure 129b; and the male genitalia as in figure 129d.

Ranging in body size from 8.5-13.5 mm.

For description and bionomics refer to Hall (1948:313-318).

Genus **EUCALLIPHORA** Townsend

Eucalliphora Townsend, 1908, Smithsn. Inst., Smithsn. Misc. Collect. 51 (2):118. Type-species, *Calliphora latifrons* Hough, by monotypy, = *lilaea* (Walker).

The diagnosis under *E. lilaea* (Walker) also fits the genus. By having the base of radius bare, the propleura, prosternum, and upper surface of lower calypter hairy, it runs near *Calliphora* Robineau-Desvoidy. It is readily differentiated by the broad frons of the male, the presence of accessory ocellar bristles and rather strong bristles along sides of facialia (fig. 130a).

For more details concerning the generic characters refer to Hall (1948:282) and to Kurahashi (1971:151).

Only one species known from Hawaii.

Eucalliphora lilaea (Walker) (figs. 130a-c)

Musca lilaea Walker, 1849, List Spec. Dipt. Ins. Coll. Brit. Mus. 4:894.

Musca ilerda Walker, 1849, List Spec. Dipt. Ins. Coll. Brit. Mus. 4:895.

Calliphora latifrons Hough, 1899, Zool. Bull. 2:286.

On all of the main islands restricted to the cooler areas, at elevations of 3,000-7,000 feet. This is evidently the species reported by Grimshaw (1901:28) as *Calliphora* sp. Two females in poor condition collected by R. C. L. Perkins at Kilauea, Hawaii, June 1895 and Kauai, 2,000-3,000 ft., January 1897. The first definite reports are from collections made at Waimea, Hawaii, June 1922, by Illingworth (1923d:277) and Bryan (1923:290) under the name *Calliphora latifrons* Hough.

Immigrant. Western North America and Alaska to Ontario, south to northern Mexico and Colorado.

Bionomics: Scavengers on excrement of carnivorous animals and other de-

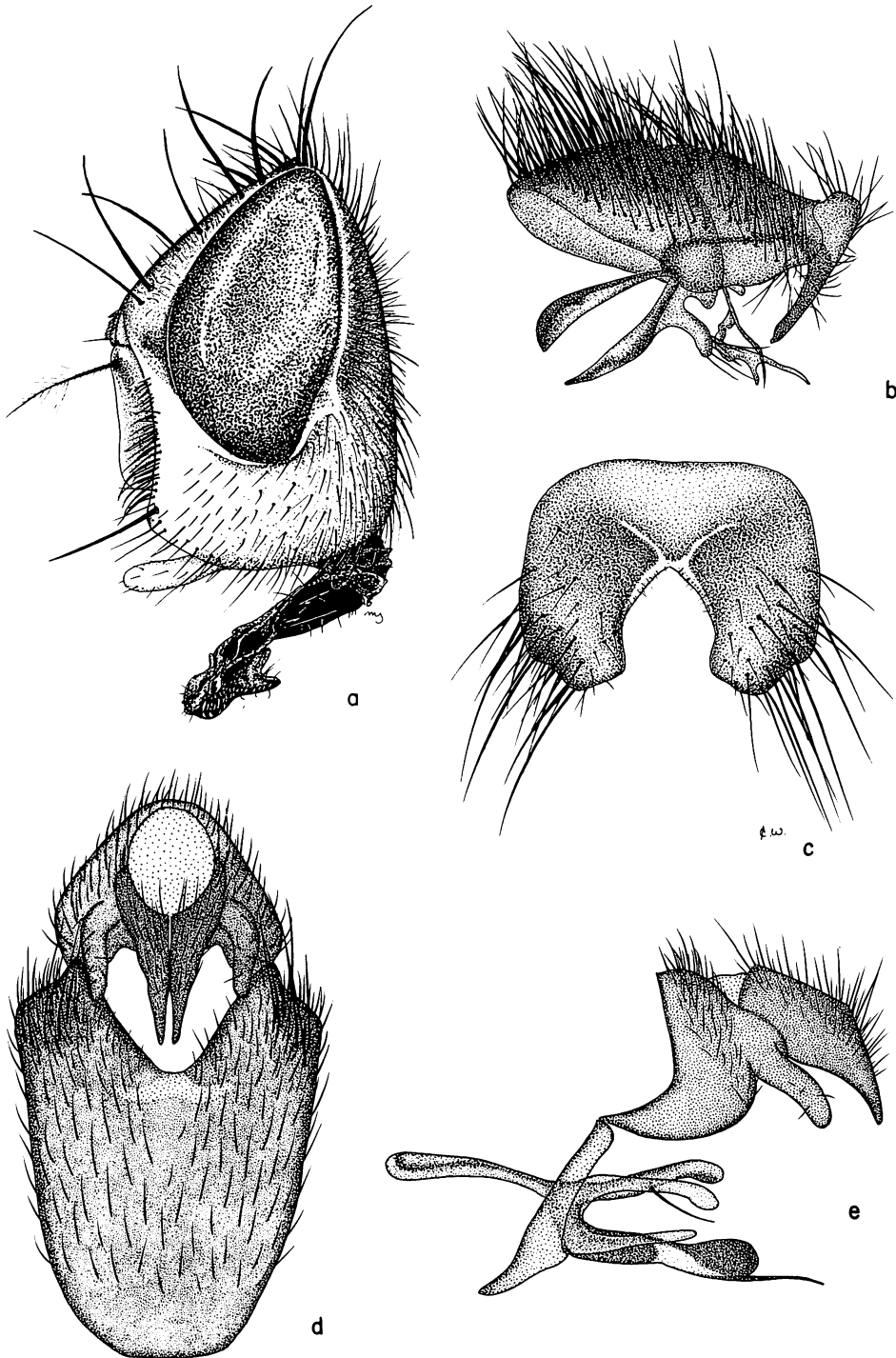


Figure 130—*Eucalliphora lilaea* (Walker): a, head, lateral; b, male genitalia, lateral; c, fifth sternum of male, ventral. *Melinda pusilla* (Villeneuve): d, male genitalia and fifth sternum, end view; e, genitalia, lateral.

caying animal matter. Hall (1948:286-287) has discussed the biology. He says this is one of the most abundant blow flies in the Rocky Mountain region of the United States, "where it appears early in the spring and remains until late September." In Hawaii a series of specimens have been reared from the bodies of dead endemic birds; in the nest of an amakihi (*Loxops virens* [Gmelin]) (Berger 1972:128) and from the body of an apapane (*Himatione sanguinea* [Gmelin]) on Haleakala, Maui. Three specimens of *Dyscritomyia grimshawi* James, n. sp. were also reared from the same bird.

Variable in body size from 6.0-11.00 mm., with the males typically smaller. Thorax dull black, lightly gray pollinose and abdomen dark metallic blue. Lower calypter brown with a white margin. Resembling *Calliphora vomitoria* (Linnaeus) but differing by having well-developed, accessory ocellar bristles and sides of facialia with strong ascending bristles (fig. 130a). Also by the comparatively broad frons of the male with the sides nearly parallel. At narrowest point, the frons are at least three times wider than ocellar triangle, over half the width of one eye and equal to the width of 27-28 rows of eye facets. In *C. vomitoria* the frons are narrow, less than the width of the ocellar triangle and equal to the width of 6-7 rows of eye facets. The male genitalia and fifth sternum differ as in figures 130b,c.

For a more detailed description including biology and immature stages, refer to Hall (1948:284-287).

Genus **MELINDA** Robineau-Desvoidy

Melinda Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Inst.

Fr.:439. Type-species, *Musca cognata* Meigen, by designation of Coquillett (1910:567), = *Musca caerulea* Meigen (preoccupied).

Refer to Kurahashi (1970) for synonymy and a revision of Australian and Oriental species.

Differentiated from other Calliphorinae which have the squamae bare above and the propleura hairy by lacking the posterior parasquamal tuft of hairs; with two pairs of presutural acrostichal setae, with the setae of each pair closer together than the distance between the two pairs; both tympanic and anterior parasquamal tufts of hair present (refer to Kurahashi 1970:522, fig. 2); male genitalia small, inconspicuous, withdrawn almost from sight and aedeagus with primitive harpes which are distinctly separated from one another for a distance from base to apex; female ovipositor elongate, especially adapted for viviparity with the terga sclerotized and the combined 8th and 9th terga shovel-shaped; the uterovaginal tube is developed into a large cavity in which the eggs are hatched.

Melinda pusilla (Villeneuve) (figs. 130d,e)

Gymnadichosia pusilla Villeneuve, 1927, Revue Zool. Bot. afr. 15:388. Type-locality: Tainan, Formosa.

Oahu. Presently known from only one male from light trap at Barber's Point, Oahu, December 1976 (J. W. Beardsley).

Immigrant: The typical subspecies is known from Burma, China, Japan and Taiwan.

Bionomics: Its biology is unknown, some other species of this genus are known to parasitize snails.

This species superficially resembles the tachinid *Euvespivora decipiens* Walker because of the principally yellow to rufous abdomen and grayish pollinose mesonotum; also the two are similar in size. The easiest way to differentiate these is to look for the absence of the metanotal swelling in *Melinda*. It is readily differentiated from all other Hawaiian calliphorids by the non-metallic body, mostly yellow to rufous abdomen, and the generic characters given above.

Kurahashi (1970:539) differentiates this from other *Melinda* of the Australian and Oriental regions by having the eyes essentially bare, with only scant, short hairs visible only under high magnification; apical portion of scutellum yellow and at least first three abdominal terga mostly yellow to rufous. In Kano and Shinonaga (1968) it is differentiated from other species known from Japan by having the femora entirely rufous and meso- and meta-thoracic spiracles yellow.

The following descriptive notes are based upon the one male specimen which has been seen to date in Hawaii.

Head about two times higher than long as seen in profile. Front strongly narrowed above, at narrowest point scarcely wider than ocellar triangle. Front with a single row of moderate bristles, extending to level with bases of antennae. Ocellar bristles scarcely longer than the black hairs on the triangle. Parafrontalia and parafacialia densely gray-white pollinose. Median portion of front opaque black on upper 2/3, reddish below. Face yellow, with the ground color obscured by dense gray pollen over the median portion, clear yellow on sides merging into the yellow to rufous ground color of the anterior and upper and lower margins of gena; with black ground color extending through median portion of gena from the occiput. A row of bristles extend along facial ridge about half the length of face. Parafacialia with 3-4 fine, inconspicuous hairs on each side on upper portion, in a line continuous with a row of 5-6 fine hairs on lower half of parafrontalia. Antennae mostly yellow to rufous with third segment brown on distal half. Third segment three times longer than wide. Arista plumose. Palpi yellow to rufous. Thorax mostly black covered with gray pollen, mesonotum with indistinct longitudinal markings but no distinct vittae. The humeri, sides of mesonotum behind suture, apical two-thirds of dorsum and all of venter of scutellum, and the spiracles yellow. Two pairs of presutural and three pairs of postsutural acrostichal bristles; three presutural and three postsutural dorsocentrals; one presutural and two postsutural intraalars; one presutural; three humerals; three posthumeral; two notopleurals; three supraalars; three postalars; eight marginal scutellars, plus two preapicals on the disc; two + one sternopleurals. Propleuron and prosternum hairy. Supra-squamal ridge bare except for anterior tuft of hairs. Postalar declivity bare.

Wings hyaline. Vein R_1 bare, $R_4 + 5$ with several short, black setae on basal node. The venation is similar to that of most calliphorids. The squamae are yellowish with pale yellow cilia on margins. Basicostal scale and epaulet yellow, tinged with brown. Halteres yellow with a brownish tinge. Legs yellow to rufous except for black tarsi. For leg bristles refer to Kano and Shinonaga (1968:46). First four abdominal segments rufous, except for a longitudinal black vitta down middle; fifth tergum black on basal median portion, rufous apically and on sides; sixth tergum and postabdomen pale rufous. It should be noted that Kano and Shinonaga (1968:46, pl. 7, fig. 14) describe and illustrate the abdomen of *pusilla* as third tergum orange with a broad median black stripe and fourth tergum black except for orange anterior margin. Also Kurahashi (1970:3) keys typical *pusilla* as having first three terga testaceous yellow. Our specimen may be a variant. The abdomen has an irregular covering of gray pollen which does not obscure the ground color. The abdomen is not strongly bristled; third tergum with small bristles along posterior margin; fourth with rather strong marginals plus 2-4 small preapical bristles in middle and three preapicals on each side; fifth entirely covered with 3-4 irregular rows of strong bristles. The venter with abundant, rather long, black hairs on sides of terga and on sterna but no distinct tufts of hairs on sterna three or four. The fifth sternum has a V-shaped cleft in middle of hind margin extending about 1/4 the length of the sclerite and is rather thickly setose, especially on posterior lobes (fig. 130d). The cerci are narrowly separated in the middle and the genitalia are as in figures 130d and 130e.

Length: body and wings 8.0 mm. Kurahashi (1970:534) gave the length as 6.0 mm., and Kano and Shinonaga (1968:45) as 5-9 mm.

Tribe LUCILIINI

Hall (1948:211) characterizes members of this tribe as having the "lower squamal lobe bare above, a parasquamal tuft of setae, and the arista usually plumose to the tip; their larvae lack an accessory oral sclerite between the labial sclerites."

Three genera fit here, in Hawaii.

For biological details of the endemic *Dyscritomyia* refer to the introduction to this family.

Genus **DYSCRITOMYIA** Grimshaw

by M. T. James

Dyscritomyia Grimshaw, 1901, Fauna Hawaïensis 3(1):21.

Prostethochaeta Grimshaw, 1901, Fauna Hawaïensis 3(1):24. **New synonym.**

Grimshaw erected two genera for the interesting group of Hawaiian endemic calliphorids treated here. He compared *Dyscritomyia* with the Oriental *Catapicephala* Macquart, and he distinguished *Prostethochaeta* from *Dyscritomyia* on the basis of a stouter body, a narrower frons in the male, and certain dif-

ferences in chaetotaxy, particularly in the number of humeral and posthumeral bristles. The type species of *Dyscritomyia* was designated as *Catapicephala limbipennis* Thomson, that of *Prostheochaeta* as *P. robusta* Grimshaw. Grimshaw distinguished *Dyscritomyia* from *Catapicephala* by its lack of "bristles on the facial ridges and in the presence of discal setae on the second and third abdominal segments."

According to Grimshaw's interpretation of chaetotaxy, there were two humerals and one posthumeral in *Dyscritomyia*; three humerals and two posthumerals in *Prostheochaeta*. With the scant amount of material that Grimshaw had for study, these differences, as well as the others that he indicated in his keys, descriptions, and discussion, appeared to be valid. With a larger amount of material, including some good series and many more species than Grimshaw knew, his classification has proven inadequate. Two alternatives remain: either to describe additional new genera, or to consider the whole complex as constituting one variable genus. If this complex were to occur over a broad continental mass, the former alternative might be the more desirable; but in a small archipelago, distant from other land areas, where, it may be assumed, this stock has radiated from probably a single introduction, the latter choice will best serve our purpose. The assumption that this stock is monophyletic is a reasonable one; though some remarkable radiation from a hypothetical ancestral form has occurred, the trends of this radiation can be mapped out without too much difficulty.

Grimshaw considered the two presutural bristles located just above the notopleuron as both posthumerals; I am considering only the anterior of these as such. Consequently, the posthumeral is interpreted as present in what Grimshaw considered *Prostheochaeta*, absent in his *Dyscritomyia*. In other words, there are three presutural bristles laterad of the dorsocentrals in the former groups, only two in the latter. Though the presence or absence of the posthumeral does not correlate satisfactorily with frons width in the male, habitus, and other characters used to separate the two nominal genera, it is useful in constructing the key and in the descriptions. Very rarely (less than in 1% of the specimens), however, a species which normally lacks the posthumeral may have one on one side or both, or a species that normally has a posthumeral may lack it. This possibility should be kept in mind in using couplet 1 of the key.

The genus *Dyscritomyia*, so far as known, is limited to the Hawaiian Islands; it occurs in one or more species on all the major islands. Most records are from elevations over 2,000 ft.

The following diagnostic features are supplied by D. E. Hardy.

Characterized by males having prominent discal and posterior bristles on terga 3-5; except in *alta* Hardy, n. sp. Females also as above in most species but lacking the discal on 3 in *affinis* Grimshaw, *cuprea* James, n. sp., *divisa* James, n. sp., *fasciata* (Grimshaw), *limbipennis* (Thomson), and *lucilioides* (Grimshaw) and usually with no discals on 3 and 4 in females of *obscura* (Grimshaw) and *retracta* James, n. sp. The latter is not constant, however, and a

small percentage of the females do have discals developed on 4. The one exception to the above is *alta*, which have no discals in either sex, although one male specimen on hand has one thin, hair-like discal bristle present on 4; other male specimens have no discals on any of the terga. The males are characterized by having very dense, moderately long, erect hairs over the abdomen and have moderately long slender posterior bristles on terga 4-5. The male genitalia and the macrolarviparous females clearly indicate *alta* is an aberrant *Dyscritomyia*. Also the presence of hairs along the suprasquamal ridge allies it to *Dyscritomyia*.

The male genitalia are distinctive; they are characterized by lacking lobes on the cerci and having two pairs of lobes developed on the epandrium (figs. 132c, 134e, 136c, 147d). The genitalia somewhat resemble those of *Xenocalliphora* (*Ptilonesia*) *auronotata* (Macquart), from Australia and New Zealand (refer to Kurahashi 1971:144, figs. 3-5), except that the cerci are not lobate. Kurahashi refers to the secondary lobes of the epandrium as "epandrium with a stout curved hook on each side."

KEY TO THE SPECIES OF DYSCRITOMYIA (Grimshaw)

1. Posthumeral bristle present (fig. 138c) 2
 Posthumeral bristle absent (fig. 141b); frons of male
 at narrowest at least 0.15 head width; ventral lobe
 of sternum 5 of male never enlarged and strongly
 produced ventrad, and either conspicuously
 haired or thickened and contorted apically. 22
- 2(1). Both sexes lacking discal (median dorsal) bristles on
 terga. Mesonotum with faint markings of brown,
 usually as indistinct vittae. Male abdomen dense-
 ly covered with moderately long, erect hairs and
 with long, slender posterior bristles on terga
 3-5. Posterior appendage of epandrium slender,
 curved downward; anterior lobe short, rounded,
 as wide as long (fig. 131c), 6,800-7,100 ft. on
 north slope of Haleakala, Maui . . . *alta* Hardy, n. sp.
 Not as above. Typical *Dyscritomyia*, i.e., males with
 strong discal bristles on terga 2-5; females usually
 so but some lacking discals on 3 and in *obscura*
 (Grimshaw) and *retracta* n. sp. usually lacking on
 3 and 4. 3
- 3(2). Males 4
 Females 14
- 4(3). Frons comparatively broad, at narrowest 0.12 head
 width (fig. 132a), equal to 11-17 rows of eye

- facets and two or more times wider than ocellar triangle 5
- Frons narrow, at narrowest not more than 0.08 head width, less than width of ocellar triangle (fig. 148a) 6
- 5(4). Lobes of sternum 5 large, triangular, and strongly produced ventrad (fig. 132d); shining species, without evident pollen except under oblique light, and with femora mostly shining green. Molokai, Maui **bryani** James, n. sp.
- Lobes of sternum 5 small, semi-oval, as seen in side view, and not so strongly produced ventrad (fig. 137b); pale pollen on thorax and abdomen clearly evident; femora yellow. Oahu. **divisa** James, n. sp.
- 6(4). Lobes of sternum 5 large, triangular to quadrilateral, strongly produced ventrad 7
- Lobes of sternum 5 small, semi-oval, or appearing triangular because of an umbo-like projection, but not strongly produced ventrad 9
- 7(6). Lobes of sternum 5 with long hairs, the longest of which equals in length the ventrad projection of the lobe; posterior margin of lobe distinctly concave; genital segments bright orange, strongly contrasting in color with terga of preabdomen. Hawaii **caudata** James, n. sp.
- Lobes of sternum 5 with relatively short hairs; posterior margin of lobe straight or slightly convex; genital segments black or green 8
- 8(7). Bright green, coppery green, blue to purple species, pollen of thorax and abdomen visible only under oblique lighting and not dimming the metallic sheen; femora and genital segments green. Molokai, Maui, Lanai **robusta** (Grimshaw).
- Less brilliantly shining species, the pale pollen evident on the thorax and abdomen and definitely dulling the metallic sheen; genital segments and femora black. Kauai **retracta** James, n. sp.
- 9(6). Lobes of sternum 5 with a slight point at apex and as seen *in situ* nearly triangular in shape (fig. 142a), and in ventral view nearly quadrate (fig. 142b); surstylus with a strong, apicoventral tooth (fig.

- 142c); body wholly blue-green, with at most only inconspicuous posterior margins on the terga; legs wholly blackish or brownish-black with green reflections; more robust species. Hawaii
 **lata** James, n. sp.
 Lobe of sternum 5 not produced, semi-oval; no strong tooth at apex of surstylus; more slender species 10
- 10(9). Broad posterior margins of terga 2-4 black, in strong contrast to remainder of respective terga, best seen in indirect light. On all major islands
 **fasciata** (Grimshaw).
 Terga 2-4 without contrasting posterior margins 11
- 11(10). Squamae and usually palpi dark brown to black; front femur black, with green reflections. Hawaii
 **obscura** (Grimshaw).
 Squamae whitish to pale yellow; palpi yellow 12
- 12(11). Femora extensively to wholly yellow; abdomen extensively yellow at base, at least; uppermost parafrontal bristles not differentiated from the others . . . 13
 All femora black with strong green reflections; abdomen wholly bright green; uppermost parafrontals differentiated as reclinate fronto-orbitals. Hawaii
 **similis** James, n. sp.
- 13(12). Bluish-green species; abdomen extensively yellow at base, particularly laterally; tibiae brown, distinctly darker than the yellow femora. Hawaii
 **lucilioides** (Grimshaw).
 Coppery species; abdomen largely yellow, with a coppery luster; tibiae yellow, concolorous with femora. Oahu **cuprea** James, n. sp.
- 14(3). Squamae dark brown, alar squama white only at base; middle and hind femora largely yellow to yellowish-orange, rarely entirely darkened; pregenital tergum (6th) entire, keeled dorsally as seen *in situ* (fig. 146c). Hawaii
 **obscura** (Grimshaw).
 Squamae yellow or white; if light brown, the pregenital tergum (6th) is divided dorsally and not keeled 15
- 15(14). At least middle and hind femora yellow to orange; pale pollen conspicuous on anterior slope of mesonotum, when viewed laterally 16

- All femora wholly black, blackish-brown, or green . . . 18
- 16(15). Sixth (pregenital) tergum divided into two separated plates (fig. 137c) extending vertically; terga broadly yellow laterally and sterna yellow 17
- Sixth tergum entire, keeled dorsally but not divided there; tergum 5 and usually 4, also posterior sterna all metallic green. Hawaii
- **lucilioides** (Grimshaw).
- 17(16). Abdominal terga blue-green dorsally, yellow only on lower lateral and apical parts; abdomen normally deep, not noticeably flattened dorsally; tibiae brown, distinctly darker than femora. Oahu
- **divisa** James, n. sp.
- Abdominal terga usually coppery-green dorsally, usually broadly yellow on sides of dorsal surface; abdomen tending to become flattened toward apex; tibiae yellow, not much darker than femora, at least on anterior surfaces. Oahu
- **cuprea** James, n. sp.
- 18(15). Pregenital tergum (6th) divided into two well-separated vertical plates (fig. 148d) lying in one plane and well sunken below apex of tergum 5. Kauai
- **retracta** James, n. sp.
- Pregenital tergum entire, keeled dorsally, when in normal position extending to apex of tergum 5 19
- 19(18). Abdominal terga with broad, well-defined, black posterior margins; thorax and abdomen conspicuously white-pollinose. On all major islands
- **fasciata** (Grimshaw).
- Abdominal terga with at most indistinct posterior margins; pollen of thorax and abdomen not conspicuous. 20
- 20(19). Larger species, usually 10 mm. or more in length; abdomen brilliantly shining, pale pollen visible only under strongly oblique lighting 21
- Smaller species, 8 mm. or less in length; abdomen dulled by pale pollen which is clearly visible at a slightly oblique angle. Hawaii
- **similis** James, n. sp.
- 21(20). Hairs of occiput and beard wholly black except next to occipital foramen; frons gradually widening from vertex to antennal bases. Molokai, Maui
- **bryani** James, n. sp.

- Hairs of lower occiput and beard yellow; frons on upper half almost parallel-sided (fig. 149a). Molokai, Maui **robusta** (Grimshaw).
- 22(1). Wing infuscated along costal margin and particularly at base, the infuscated area clearly distinguishable, though not always sharply demarcated 23
 Wing uniformly hyaline, uniformly lightly infuscated, or lightly infuscated anteriorly and grading into hyaline posteriorly 30
- 23(22). Abdomen very deep (high), almost or fully as deep as wide; fifth sternum of male developed into a small median lobe (figs. 147b and 152b); sternum 4 of male projecting, armed apically with either a median clump of spine-like bristles (fig. 152d) or a divided comb of short, heavy spines (fig. 147c); male genitalia as in figures 147a and 152a; middle femur of male thickened and profusely bristly and hairy (figs. 147d and 152c) (females unknown) 24
 Abdomen of usual depth, usually much broader than deep; lobe of sternum 5 of male bilobed and with conspicuous hairs or, if not, parts of genitalia conspicuously hairy; sternum 4 not produced and without conspicuous spine-like bristles or comb apically; genitalia not as above; middle femur not conspicuously bristly and hairy 25
- 24(23). Sternum 1 of male with a row of 6 strong, erect, spine-like bristles apically (fig. 152d); surstylus (posterior lobe of epandrium) strongly curved downward, serrated on upper apical margin (fig. 152a). Hawaii. **sternacantha** James, n. sp.
 Sternum 4 of male with a divided comb of stiff setae apically (fig. 147c); surstylus very broad, with a dense clump of dorsoapical hairs (fig. 147a). Hawaii. **pectinata** James, n. sp.
- 25(23). Bright metallic-green species; parafacials whitish-pollinose but not strikingly silvery 26
 Bluish-green, blackish-green, or black species; parafacials strongly silvery pollinose and broad, at their minimum at least as wide as length of second antennal segment 27
- 26(25). Larger species, usually 9.0 mm. or more in length; parafacials about as wide as length of second

antennal segment; mesonotum with regularly distributed, though not abundant, pile, which is sparser and less regularly distributed in the female than in the male; sterna 3 and 4 of male with only ordinary pile and setulae. Oahu

. **terryi** Bryan.

Smaller species, 6.5 mm. or less in length; parafacials distinctly narrower than length of second antennal segment; mesonotum with sparse and irregularly distributed pile, which is often lacking or almost so medially, especially in the female; sterna 3 and 4 of male each with a dense brush of soft, crinkly hairs which form a scopa-like mass. Molokai, Maui **scopifera** James, n. sp.

- 27(25). Wing brown anteriorly, but distinctly yellow, in contrast, at the base; front basitarsus of male armed with a curved, pointed spur-like projection. Oahu, Kauai, Molokai.
 **limbipennis** (Thomson).

Wing brown at base as well as anteriorly; front basitarsus of male simple 28

- 28(27). Abdomen black, any dark green reflections limited to its sides; three humerals; parafacials distinctly narrower than distance between vibrissae. Kauai. **nigerrima** James, n. sp.

Abdomen dark greenish-black or bluish-black, terga with broad, black, posterior margins dorsally; two humerals; parafacial about as broad as distance between vibrissae 29

- 29(28). Infuscation of anterior part of wing filling basal cell R_5 before r-m crossvein; male with lobe of sternum 5 attenuated strongly and curved apically, profusely hairy below, surstyli of male (posterior lobe of epandrium) without dorsal brush of erect hairs (fig. 141d); frons of female at narrowest 0.27–0.30 head width. Lanai, Maui, Hawaii. **hawaiiensis** Grimshaw.

Infuscation of anterior part of wing not extending into the basal section of cell R_5 , or but lightly so; lobe of sternum 5 broad and rounded apically; each surstylus with a strong dorsal brush of erect hairs on its basal part (fig. 140d), these hairs crinkly apically and projecting forward between

- the sternal lobes in the unspread genitalia; frons of female about 0.33 head width. Maui, Hawaii **grimshawi** James, n. sp.
- 30(22). Abdomen bright metallic green, sometimes with coppery reflections; parafacials of male distinctly narrower than third antennal segment. 31
- Abdomen dark, steel blue; parafacials in both sexes as broad as or broader than third antennal segment. Fifth sternum and male genitalia as in figures 134c-e, 140d,f. 33
- 31(30). Abdominal terga with distinct bluish-black posterior margins 32
- Abdominal terga unicolorous, or at most with very indistinct borders. Oahu and Hawaii 34
- 32(31). Lobe of sternum 5 broad, suboval, about as wide as long as seen in side view (fig. 139b); sterna 3-4 not covered with dense black hair. Lanai. **fulgens** Grimshaw.
- Lobe of sternum 5 elongated, digitate, in lateral view, about four times longer than wide (fig. 136a). Third and fourth sterna densely black haired. Maui **digitata** James, n. sp.
- 33(30). Parafacials very broad, nearly two times wider than third antennal segment (fig. 140a). Mesonotum, scutellum, and pleura, including sternopleura, rather densely long black haired; also posterior surface of front femur densely long haired. Lobes of fifth sternum of male rounded; surstyli each with a dense clump of curled hairs dorsally (fig. 140d). Third sternum nearly bare, with only short inconspicuous setae and fourth with comparatively short, straight hairs (fig. 140b) (Teneral specimens will run here). Maui, Molokai. **grimshawi** James, n. sp.
- Parafacials about equal to, slightly wider than third segment (fig. 134a). Thorax with the usual covering of short, scattered setae; sternopleura with a few setae only on lower portion. Lobes of fifth sternum tapered; hairs on surstyli not so densely clumped and nearly straight (fig. 134e). Second sternum with numerous, prominent setae on posterior portion and hind portion of fourth very

densely covered with crinkly hairs (fig. 134d).

Hawaii **claripennis** Grimshaw.

- 34(31). Eyes of male close together on the front, at narrowest point the frons is scarcely wider than the median ocellus; squamae dusky, tinged with brown, upper lobe brownish on front margin; abdominal terga entirely metallic green or coppery green with no darker coloring on hind margins.

Hawaii **viridis** Hardy, n. sp.

Eyes of male rather widely spaced, the frons about three times as wide as ocellar triangle; squamae entirely white; hind margins of terga with at least a faint darkened border. Oahu . . . **affinis** Grimshaw.

Dyscritomyia affinis Grimshaw

Dyscritomyia affinis Grimshaw, 1901, Fauna Hawaiiensis 3(1):23.

Endemic. Oahu (type-locality: Waianae Mts.). Kauai.

Type male in the British Museum (Natural History).

I have identified this species positively only from the Waianae Range on Oahu. The relationship to *fulgens* Grimshaw is very close and the two species may be synonymous. The latter has distinct, broad, black posterior borders on the terga; in *affinis* these borders are obscure or lacking. The male genitalia appear to be identical and males of both species have been taken on Mt. Kaala in the Waianae Range, Oahu. [James' figures of '*fulgens*', 139a-c, evidently pertain to this species. D.E.H.].

Length: body, 4.5-7.0 mm.

Dyscritomyia alta Hardy, new species (figs. 131a-h)

An aberrant species which differs from all known *Dyscritomyia* by lacking dorsomedian (discal) bristles on terga 3-5. The male genitalia, however, fit *Dyscritomyia*, and this is obviously just another example of the unusual departures from the normal which so frequently occur in the Hawaiian insects. I do not feel that the lack of discal bristles in this particular case is of any generic importance. In reviewing all of the *Dyscritomyia* species, there is a tendency for reduction of discals in some of the species; however, this occurs only in the females. In females of *affinis* Grimshaw, *cuprea* James, n. sp., *divisa* James, n. sp., *fasciata* (Grimshaw), *limbipennis* (Thomson), and *lucilioides* (Grimshaw), the discals are present on terga 4 and 5 but absent on 3. In *obscura* (Grimshaw), and *retracta* James, n. sp., no discals are present on 3 and usually these are absent also on 4; however, in occasional specimens the bristles are present on 4.

MALE. *Head*: Frons comparatively narrow, at narrowest point equal in width to five rows of eye facets and less than one-twelfth the width of the head.

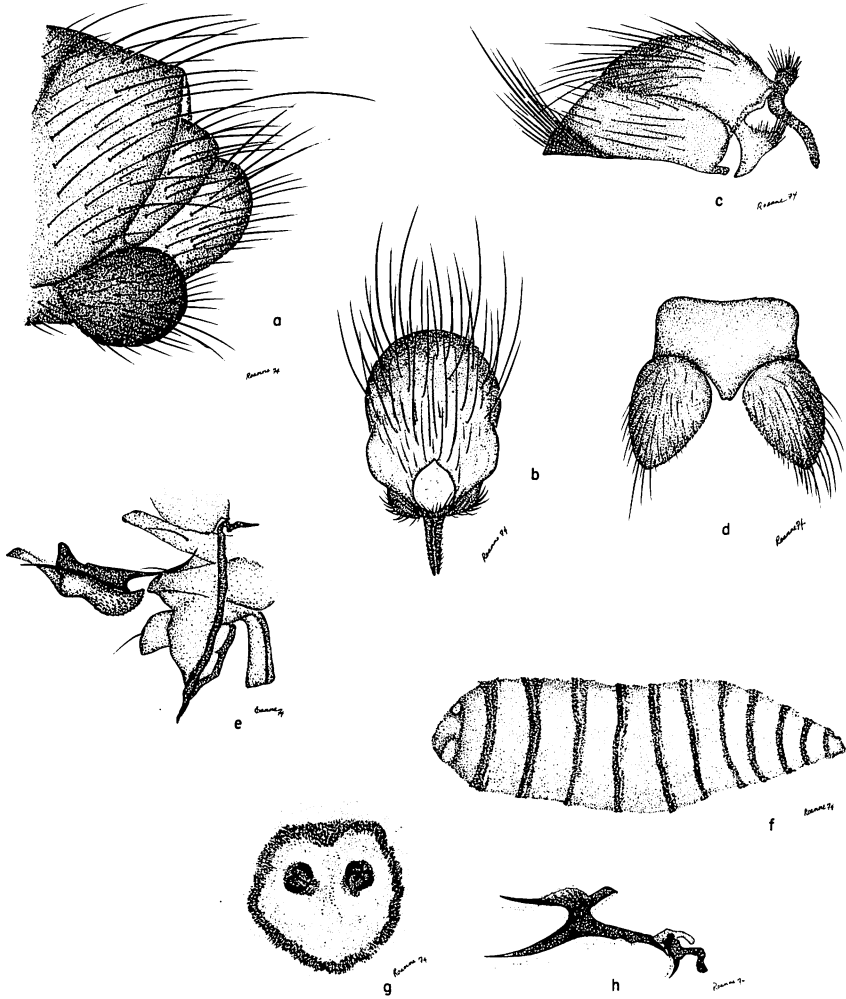


Figure 131—*Dyscritomyia alta* Hardy, n. sp.: a, apex of male abdomen, lateral, *in situ*; b, male genitalia, end view; c, male genitalia, lateral; d, fifth sternum of male, ventral; e, aedeagus and hypandrium; f, second instar larva, lateral; g, posterior spiracles of second instar larva; h, cephalopharyngeal skeleton of second instar.

Thorax: Metallic blue, with a purple sheen on the scutellum and posterior portion of mesonotum. Mesonotum with a short streak of gray pollen on each side, extending from anterior margin to just beyond anterior dorsocentral bristle, also the anteromedian portion of the mesonotum is gray pollinose in the area occupied by the two anterior pairs of acrostichal bristles. A faint indication of a brown vitta is present on each side in area between dorsocentrals and acrostichals, extending from front margin to about level with the median postsutural dorsocentrals and another is present in area between dorsocentrals

and intraalars, extending from posthumeral bristle to just beyond anterior intraalar but broadly interrupted at suture. Posthumeral bristles well developed, fitting in the "Prosthechaeta" grouping of species. Two presutural and two prescutellar acrostichals, two presutural and three postsutural dorsocentrals, and three humerals present. The anterior pair of prescutellar acrostichals rather poorly developed, hair-like, less than two times longer than other hairs on mesonotum. Hairs of mesonotum and scutellum slender and moderately long. *Legs*: Simple, entirely black, with femora metallic blue as seen in some lights. *Wings*: Pale brownish, more heavily infuscated toward costal margin and especially toward base. Costal spine small. Basicosta brown at base, yellow-brown to yellowish apically. Upper lobe of squama dirty white, rim and fringe brown to black. Lower lobe of squama brown, fringe yellow. *Abdomen*: Metallic blue, some specimens with a purple sheen as seen in some lights, densely covered with erect, rather long hairs. Lacking discal bristles, although in the type specimen, one discal is present on fourth tergum; this is long, slender, hair-like but is a distinct bristle, almost equal in length to the posterior bristles on that segment. Posterior bristles of terga 2 and 3 confined to lateral margins and terga 4-5 with longer, slender, bristles along posterior margins. Lobes of fifth sternum large, conspicuous, broadly rounded and about as wide as long (figs. 131a and 131d). Genitalia entirely metallic blue-black, structured as in figures 131b,c. Aedeagus serrated on ventral margin (fig. 131e).

Length: body and wings, 7.0-7.5 mm.

FEMALE. Front about one-third as wide as head, margins gradually diverging anteriorly. Median portion of mesonotum mostly subopaque brown, almost completely obscuring the metallic blue ground color. Thorax and abdomen lacking the abundant long hairs of the male and setae of abdomen subrecumbent. Sixth tergum completely divided in middle except for a thin line of sclerotin along anterior margin.

Length: 6.5-8.5 mm.

LARVA. The mature second instar larva measures 4.75 mm. A broad band of microscopic black setae occurs at the junction of each segment (fig. 131f). The posterior spiracles are as in figure 131g and the cephalopharyngeal skeleton is as in figure 131h.

Holotype male and allotype female: upper Hana Forest, Maui, elevation 7,100 ft., basecamp for National Science Foundation Student Organized Study Project, on edge of Alpine Meadow, October 6, 1973 (C. W. Whittle).

***Dyscritomyia bryani* James, new species (figs. 132a-d)**

A glossy green species of the general appearance of *D. robusta* (Grimshaw), but the fifth sternum and male genitalia are very different in development (compare figs. 132c,d and 149b-d) and the broader front of the male (fig. 132a). It appears most closely related to *divisa* James, n. sp. but differs by the shining green femora and the differences in the development of the fifth sternum (figs. 132d and 137b) and the male genitalia (figs. 132c and 137a).

MALE. Frons at narrowest 0.10–0.13 head width, widening to 0.20 at vertex and 0.25 at lunule; frontalia at narrowest, wider than a parafrontal; parafacials approximately parallel-sided (fig. 132a). Head black; parafrontals subshining green, sometimes black, next to ocellar triangle, becoming densely white-pollinose below; parafacials, facials, middle of face, and occipital orbits densely white-pollinose; frontalia velvety black. Parafrontals 8–12, usually

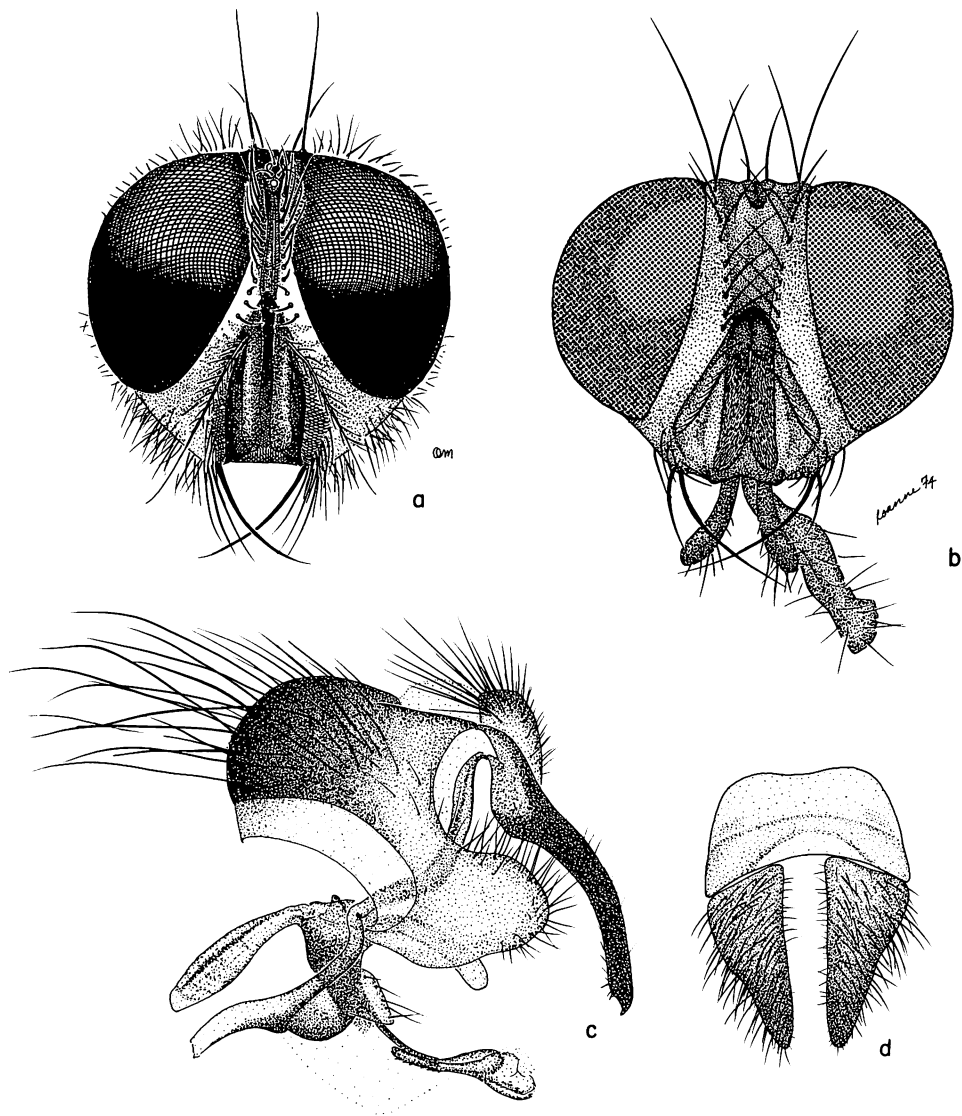


Figure 132—*Dyscritomyia bryani* James, n. sp.: a, head of male, front view; b, head of female, front view; c, male genitalia, lateral; d, fifth sternum of male.

11-12, reclinate upper pair stouter and longer than the others; outer verticals not differentiated; some hairs on parafrontals; facials with weak cilia only near vibrissae. Vestiture of head black except just below neck. Antenna almost reaching vibrissae; flagellum about 3.5 as long as pedicel and 4.0 as long as wide; arista yellow on about median third, otherwise dark brown to black, with about 15 long rays and some short basal pubescence above, about 12 long rays below. Palpi and proboscis dark brown to black.

Thorax bright green, pollen visible only under strongly oblique light; a very narrow shining coppery vitta between the presutural acrostichal and dorsocentral rows; humerals 3; posthumeral present; discoscutellars 0-2, small when present. Hairs of mesonotum short, erect, moderately abundant; those of scutellum somewhat longer; propleuron distinctly haired. Vestiture of thorax black.

Legs black; femora in certain lights with green reflections. Legs simple; middle tibia with a posterodorsal row consisting of two longer and one to several shorter bristles. Wing pale brownish, more heavily infuscated toward the costal margin, especially toward the base, and becoming more hyaline posteriorly; costal spine small but distinctly differentiated. Squamae pale yellow to deep yellow; halter yellow, stalk yellow to brown.

Abdomen shining green with considerable coppery reflection. Abdominal bristling strong but variable; tergum 1 with or without median marginals; 2-4 with one or two median dorsals; 2 with median marginals, 3 and 4 with marginal rows. Hairs of abdomen abundant, moderately short dorsally, longer ventrally and laterally; some of latter, especially at base, quite long and silky. Lobes of fifth sternum large but without unusual hairs, about two times longer than wide and concave posteriorly as seen in side view; gently tapered as seen from ventral view (fig. 132d). Hypopygium small. Genitalia as in figure 132c, with the surstylus sharply pointed at apex and the secondary lobe of epanthrium greatly expanded, broadly rounded.

Length: 8.0-12.0 mm.

FEMALE. Head as in figure 132b. Vertex 0.25 head width, frons gradually broadening to 0.35 across lunule; parafacial 0.13 head width at antennal base, narrowing to 0.08 at gena. Fifth tergum highly arched, undivided.

Length: 9.5-10.5 mm.

Holotype male: Kainalu, Molokai, 2,000-3,000 ft., July 28, 1927 (E. H. Bryan, Jr.). Ten paratypes, 7 males and 3 females, from following localities on Molokai (same data as type): some 1,800-2,500 ft., July 29; Puu Alii, July 1953 (M. Tamashiro); Kawela, 3,700 ft., December 23, 1925 (E. H. Bryan, Jr.); also one male each from Iao Valley, Maui, July 29, 1906 (O. H. Swezey); and Waikamoi, Maui, June 25, 1920 (E. H. Bryan, Jr.).

Three males from Maui appear to be this species but the lobes of the fifth sternum are not nearly so concave posteriorly. The data on these specimens are: 1 male, Iao Valley, July 29, 1906 (O. H. Swezey); 1 male, Waikamoi, June 25, 1920 (E. H. Bryan, Jr.); 1 male, Iao Valley, February 1928 (F. X. Williams).

Holotype and some paratypes are in the B. P. Bishop Museum; additional paratypes are in the collections of the University of Hawaii and Washington State University.

***Dyscritomyia caudata* James, new species (figs. 133a-c)**

Fitting in the "Prostethochaeta" species group and closely related to *retracta* James, n. sp. It is readily differentiated by the bright orange-red genitalia of the male, the long dense hairs on the lobes of the fifth sternum (figs. 133a,b and 148b,c) and by the genital characters (figs. 133c and 148a).

MALE. Frons about 0.05 head width at narrowest, increasing to 0.15 at vertex and to 0.25 across lunule; frontalia linear at narrowest; parafacial about 0.13 above, narrowing to 0.09, then widening to gena. Head mostly black, lower frontalia, parafacials inwardly and on lower part, also genal depression, brown. Pollen of parafrontals, face, and upper parafacials only moderately dense; gray to yellowish gray; almost lacking on parafrontals laterad of ocellar triangle, which is subshining; that of middle parafacials, facials, and middle of face thicker and more whitish. Outer verticals weak but differentiated from occipital orbital fringe; 15-16 fronto-orbitals, rather long but not strong, uppermost reclinate but not otherwise differentiated from the rest; parafrontals and parafacials virtually bare, only 3 or 4 hairs visible on parafrontal and a group of more noticeable but scattered ones on genal depression; vestiture black except on lower part of occiput where the hairs are pale yellow. Antenna black; flagellum moderately slender, almost reaching vibrissa, 3.25 as long as pedicel and about 3.5 as long as wide; arista black at base, then yellow, becoming brown apically, with 12-13 long rays above and 5 shorter ones below. Palpi black, gray-pollinose; proboscis black.

Thorax blue-green with strong purple reflections dorsally and on lower pleura; two blackish vittae between dorsocentral and acrostichal rows, reaching almost to suture, these vittae and area between them densely white-pollinose, pollen best seen from posterior view; propleuron and lower half of remaining pleural area with noticeable white pollen, pollen of thorax otherwise visible only under oblique lighting but then well noticeable on dorsal areas. Dorsocentrals 2,3; acrostichals 2,2; humerals 2; posthumeral present; discoscutellars 2, weak. Hairs of mesonotum erect, well distributed but not dense, moderately short, becoming longer on prescutellar area, those of scutellum much longer than those of mesonotum. Vestiture of thorax black.

Front coxa black, strongly grayish white pollinose; other coxae and all femora mostly shining green; tibiae and tarsi black. Legs simple; hind tibia with anterodorsal row of short bristles but including one long medial one. Wing uniformly light gray, almost hyaline, except at extreme base, where it is distinctly infuscated, this area extending a little beyond humeral crossvein except that it also fills the narrow part of cell Sc. Costal spine not developed. Halter brown, knob yellow; thoracic squama heavily infuscated, alar 1 more lightly so.

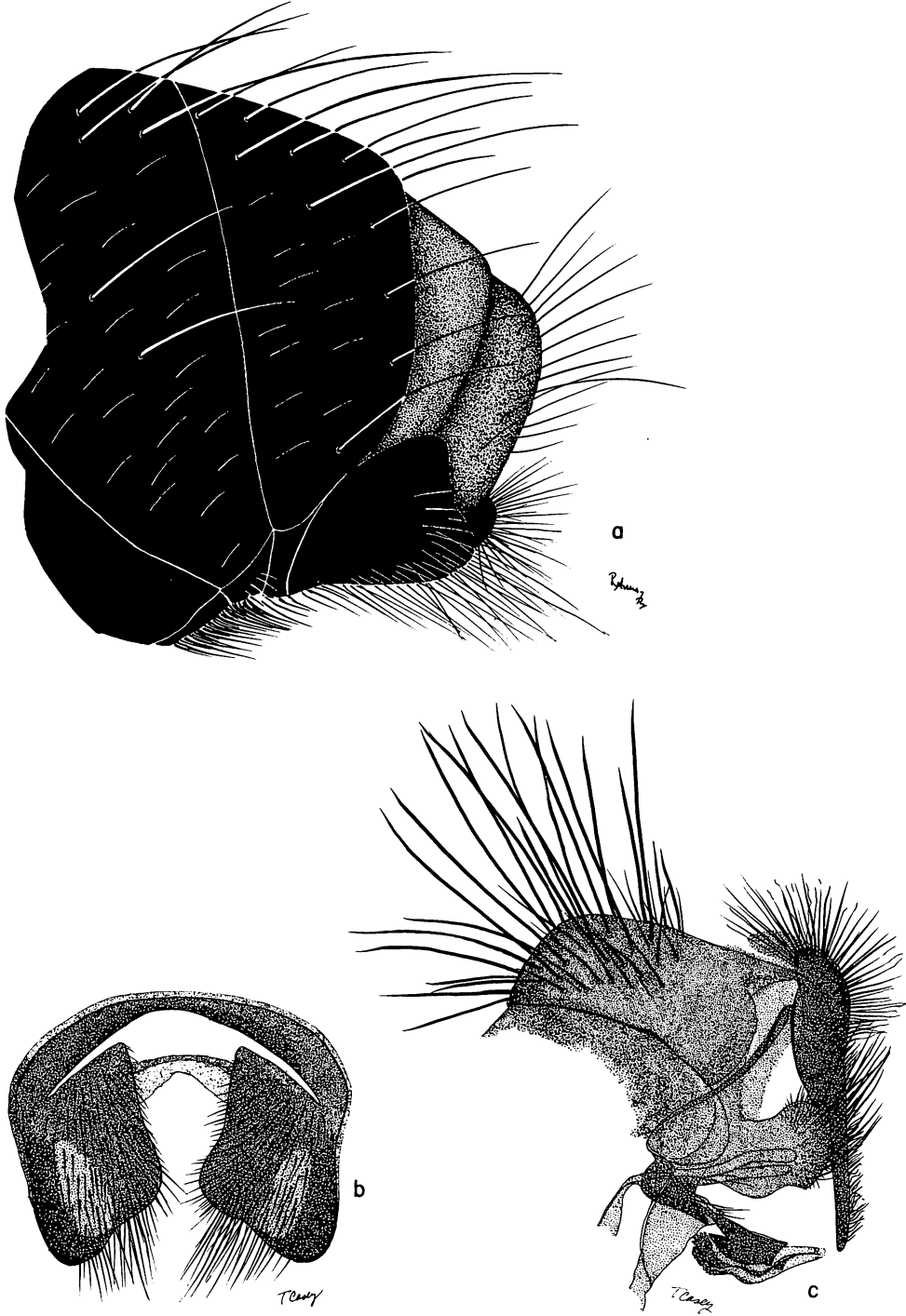


Figure 133—*Dyscritomyia caudata* James, n. sp.: a, apex of male abdomen, lateral, *in situ*; b, fifth sternum of male; c, male genitalia, lateral.

Abdomen bright blue-green with strong purple reflections, becoming green on tergum 4; whitish pollen clearly evident on bare basal area of sides of tergum 1 and on ventral margins of terga, otherwise visible only under oblique lighting but then clearly evident. Pile of abdomen long and mostly erect; all abdominal vestiture black. No median marginals but a strong lateral marginal on tergum 1; 2 median dorsals and 1 median marginal plus weak marginal row on 2; long median dorsal on 3 and scattered median dorsals on 4; marginal row on 3 and 4. Lobes of fifth sternum (figs. 133a,b) prominent, densely long haired on ventral surface and projecting rather strongly ventrad, the upper posterior margin concave slightly; mostly black with greenish reflections. Genitalia as in figure 133c; both genital segments bright orange-yellow, strongly contrasting in color with rest of abdomen.

Length: 8.0 mm.

FEMALE. Unknown.

Holotype male: Kilauea Forest, Hawaii, March 18, 1972 (M. D. Delfinado).

The holotype is in the collection of the B. P. Bishop Museum.

***Dyscritomyia claripennis* Grimshaw (figs. 134a-e)**

Dyscritomyia claripennis Grimshaw, 1901, Fauna Hawaiiensis 3(1):23.

Endemic. Hawaii. The type series consists of two males from Olaa and Kona, 3,000 ft. In British Museum (Natural History). Known only from the type series and one male, from Kilauea, Hawaii.

The following descriptive notes based upon the specimen from Kilauea are by D. Elmo Hardy.

Fitting in the group of species characterized by lacking posthumeral bristles, having wings rather uniformly hyaline, and parafacials broad and densely silvery pollinose. It fits near *grimshawi* James, n. sp., from Maui and Hawaii, but is readily differentiated by the narrower frons and parafacials (fig. 134a); lack of long hairs on thorax and nearly bare sternopleura; also by the vestiture on the abdominal sterna, and by the development of the fifth sternum and the male genitalia (figs. 134c-e).

Male frons about one-seventh the head width, at narrowest point about two times wider than ocellar triangle and equal to the length of 13 rows of eye facets. Parafacials about equal to or slightly wider than third antennal segment (fig. 134a). The divergence of eye orbits begins near middle of head, as seen in direct frontal view, and is much more gradual than in *grimshawi*. Thorax dark blue-green. Two pairs presutural and one pair prescutellar acrostichals present. Sternopleuron bare of setae except at extreme lower margin, with one bristle-like hair in upper median portion, posteroventrad to the anterior sternopleural bristle. Posterior portion of front femur conspicuously setose but not so long haired as in *grimshawi*. Wings nearly hyaline, anterior portion not noticeably darkened. Abdomen dark greenish blue with posterior margins of terga purplish black (fig. 134b). Sternum 1 + 2 with numerous long, curled hairs on posterior half of sclerite. Third sternum with numerous moderately

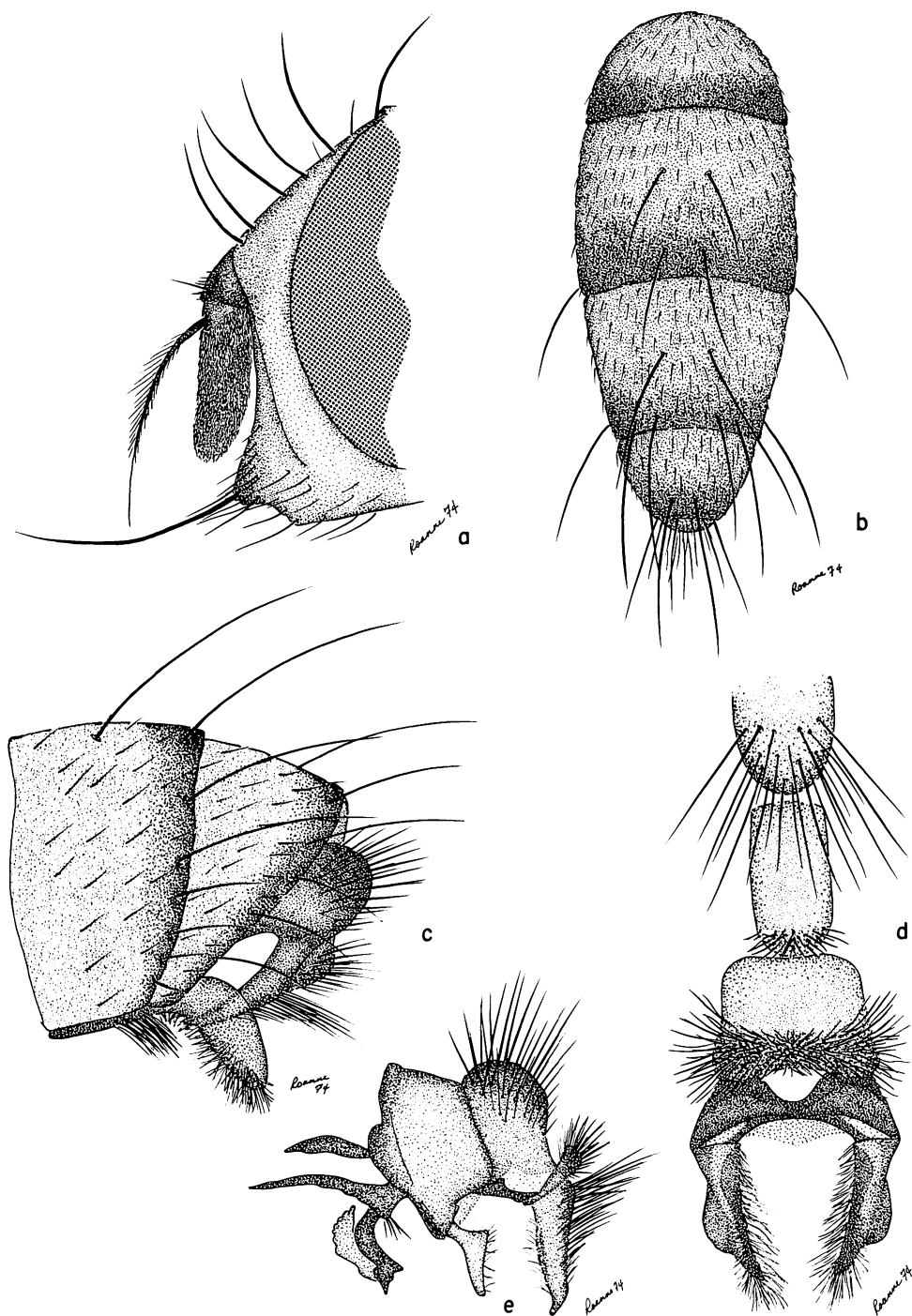


Figure 134—*Dyscritomyia claripennis* Grimshaw: a, front of head, lateral; b, abdomen, dorsal; c, apex of male abdomen, lateral, *in situ*; d, male sterna, ventral; e, male genitalia, lateral.

long hairs on apical portion and apical 1/3-1/4 of fifth sternum densely covered with crinkly hairs (fig. 134d). Fifth sternum densely, crinkly haired on ventral margin and on inner surface, the lobes are gradually tapered and readily visible *in situ* (fig. 134c). The surstyli have moderately long, rather straight dorsal hairs and are strongly tapered at apices. The secondary appendages of the epandrium are gradually tapered, as in figure 134e.

Grimshaw gave the measurements as body, 6.0 mm.; wing, 5.0-5.5 mm. A male specimen on hand from Kilauea, Hawaii, measures 7.0 mm. for the body and 6.2 mm. for the wings.

***Dyscritomyia cuprea* James, new species (figs. 135a-c)**

Fitting in the "Prostethochaeta" species group, near *lucilioides* (Grimshaw) but differing by having the body coppery colored and abdomen largely yellow; the tibiae yellow, concolorous with the femora and the anterior lobes of the epandrium different in development, as in figures 135c and 144a.

MALE. Frons at narrowest 0.07 head width, widening to 0.15 at vertex and 0.20 across lunule; frontalia evident throughout, about as wide at narrowest as a parafacial at the same point, about half width of frons at lunule; parafacial narrow, about 0.05 head width, almost parallel-sided but widening toward gena. Head mostly black; frontalia reddish orange below, becoming brown, then black at ocellar triangle; parafrontals except above and parafacials orange-yellow to orange, under dense yellow pollen which extends even onto black upper parts of parafrontals but becomes white laterad of ocellar triangle; epistoma yellow, facials, and middle of face black, under dense whitish pollen; pollen of occipital orbits dense, pale, becoming whitish above, on genae and on occiput. Parafrontals 11, uppermost not reclinate and not distinguishable from the others; outer verticals present but weak; parafrontals and parafacials without hairs; facialia weakly ciliate on lower third. Hairs and bristles of head black except on occiput below neck. Antenna reaching almost to vibrissae; flagellum 4.0 as long as pedicel and 4.0 as long as wide; antenna orange at extreme apex of pedicel and base of flagellum, otherwise brownish black to black. Arista brownish black, yellowish brown on second fourth from base; about 20 long rays above and 8 below. Proboscis dark brown. Palpi yellow.

Thorax olive-green, brighter on scutellum, mostly dulled with white pollen, conspicuously so on pleura, and with strong coppery reflections under certain lights; a pair of narrow darker vittae before suture, between acrostichal and dorsocentral rows, visible from anterior view. Hairs erect, moderately sparse but evenly distributed on mesonotum, longer on scutellum and pleura; white on propleuron, otherwise black. Covers of anterior and posterior spiracles yellow. Acrostichals 2,3; dorsocentrals 2,3; humerals 3; posthumeral present; costal spine small; discoscutellars 2 pairs in a transverse row (probably variable).

Legs simple; coxae, femora, and tibiae bright yellow, tarsi brownish-black. Ventral pubescence of front basitarsus brown, hairs and bristles of legs otherwise black. Wing pale yellowish brown, gradually becoming almost hyaline

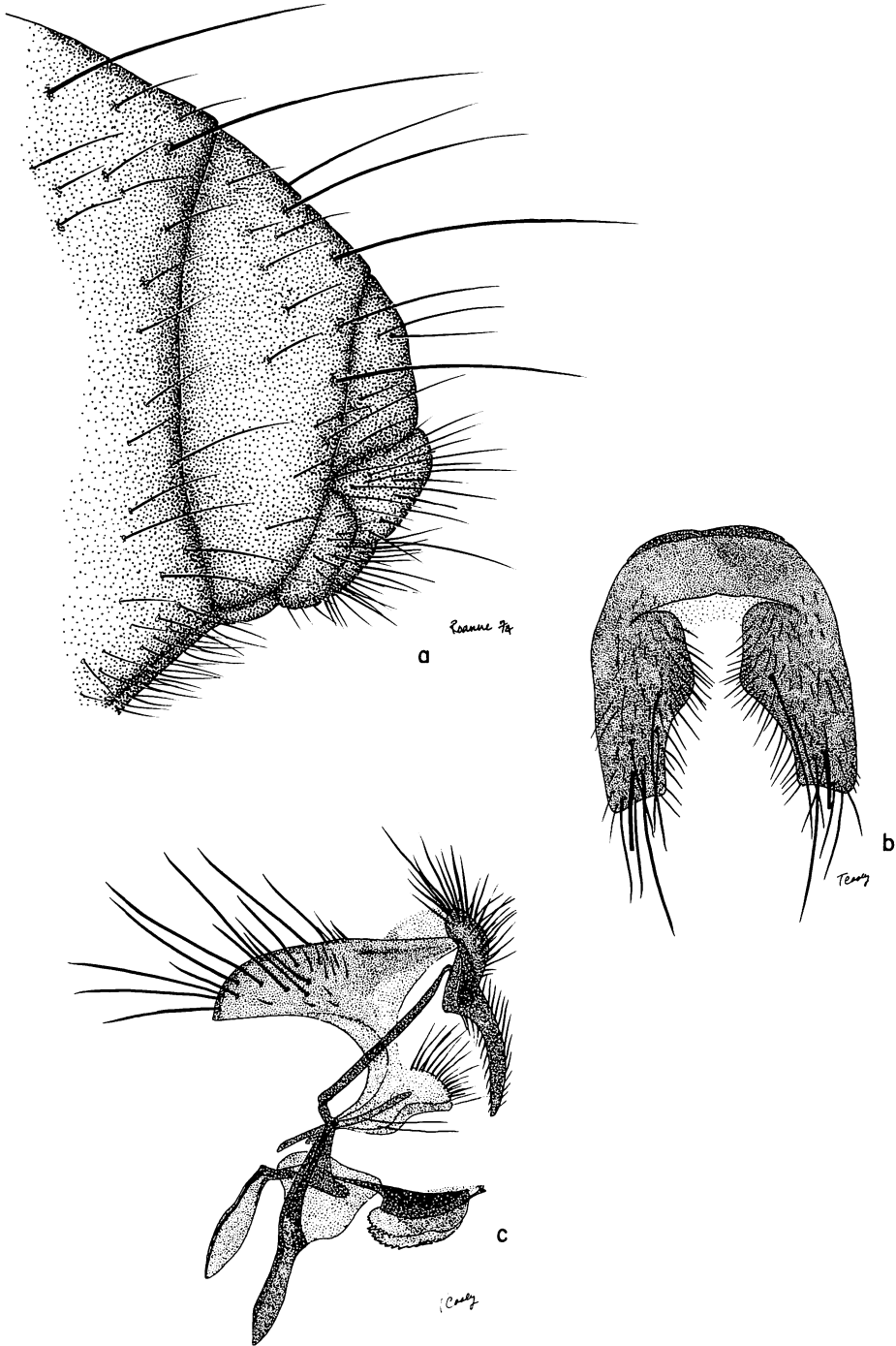


Figure 135—*Dyscritomyia cuprea* James, n. sp.: a, apex of male abdomen, lateral, *in situ*; b, fifth sternum of male; c, male genitalia, lateral.

posteriorly. $R_4 + 5$ ciliate almost half way to r-m. Costal spine small. Squamae pale yellowish brown; halteres orange.

Abdomen mostly yellow, becoming orange on bare dorsal part of tergum 1 and on tergum 4; about median fourth of dorsal aspect of tergum 2, narrowing onto 3, and ending in a small area at median base of 4, metallic green, but this color merging into the yellow—the green area consequently not clearly defined; dorsal and lateral aspects of terga with green to coppery reflections under oblique light. Tergum 2 with median dorsal, 3 with 1 to 2 pairs of median dorsals; 2 with strong median marginals and weak marginal row, strong marginal rows on 3 and 4; 1 with weak marginal row plus 1 or 2 strong laterals on side of tergum 1. Hairs of abdomen black, dense on posterior part of tergum 1 mesad of laterals, otherwise well distributed except on the usual bare areas, all of moderate length, none conspicuously long. Lobe of sternum 5 narrow, irregularly oval (figs. 135a,b). Genitalia as in figure 135c.

Length: 8.3 mm.

FEMALE. Vertex 0.20–0.25 head width, frons gradually widening to 0.33 head width. Proclinate fronto-orbitals 1–2, reclinate fronto-orbital 1, outer verticals well developed. Head more extensively blackened than in the male; parafacials and parafrontals largely to wholly black, frontale reddish only near lunule. Pollen of head paler than in male, pale yellow or whitish. Coppery sheen of thorax variable, sometimes very prominent, sometimes giving way to green. Abdomen variable, either as in male or with green more extensive, sometimes extending over most of dorsal surface, but sides and ventral surfaces of terga yellow. Abdomen flattened dorsally, much more so than in *divisa*, broad, conical; tergum 5 divided mid-dorsally, as in *divisa*.

Length: 8.0–9.5 mm.

Holotype male: Waianae Mts., Oahu, “1–5–52” (?January 5, 1952), Coll. (E. J. Ford). Eight paratypes, all females, from following localities on Oahu: (same data as type): S. Kipapa Ridge, October 7, 1927 (W. H. Meinecke); Kipapa Gulch, September 18, 1934 (E. H. Bryan, Jr.); Waianae, May 1, 1913; 1 female, Waianae Mts., Honouliuli For. Res. fork of Kaluaa Gulch, near Puu Hapapa 650 m., May 21, 1972 (W. C. Gagne); 7 miles northwest of Puu Pane, November 11, 1970; with larva extruding, Kaluaa Gulch/near Puu Hapapa, July 30, 1972 (C. Whittle).

The holotype and some paratypes are in the B. P. Bishop Museum; additional paratypes are in the collections of the University of Hawaii and Washington State University.

***Dyscritomyia digitata* James, new species (figs. 136a–c)**

Fitting in the species group which lacks the posthumeral bristle and near *fulgens* Grimshaw. It is differentiated by the elongate lobes of the fifth sternum and densely haired third and fourth sterna (fig. 136a). Also, the anterior lobes of the epandrium are elongate, slender (fig. 136c), very different in shape than *fulgens* (fig. 139c).

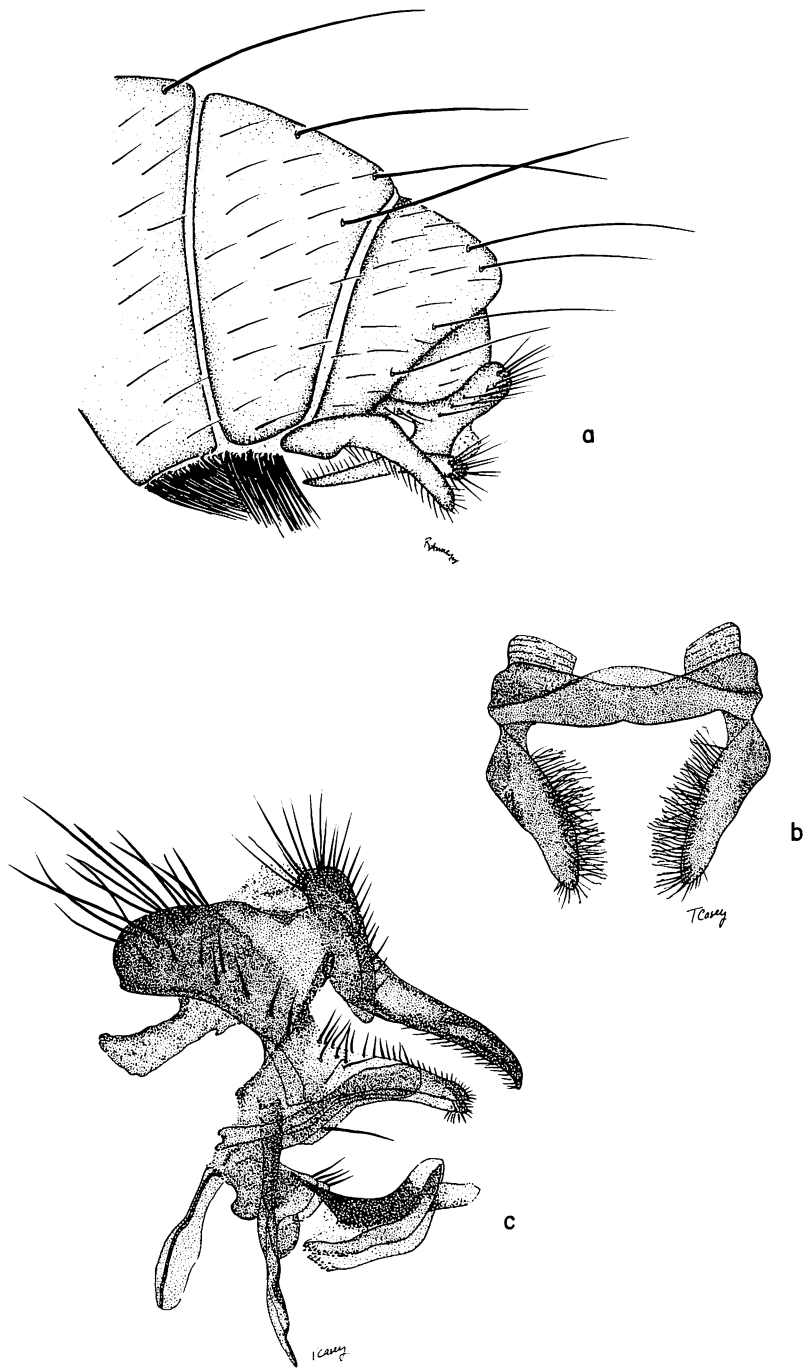


Figure 136—*Dyscritomyia digitata* James, n. sp.: a, apex of male abdomen, lateral, *in situ*; b, fifth sternum of male, ventral; c, male genitalia, lateral.

MALE. Frons at narrowest about 0.15 head width, broadening to 0.25 at vertex and 0.25 across lunule. Frontalia at narrowest about 0.08 head width; parafrontal at antennal bases, 0.12, narrowing to 0.07 at gena. Head black; parafrontals and occipital orbits, also parafacial, densely white-pollinose, middle of face less densely so; frontalia with dull brown pollen, that color more evident under oblique lighting. Vertex subshining. All head hairs and bristles black. Outer verticals not differentiated; parafrontals 8, uppermost pair stronger and reclinate, a few hairs, some of them bristle-like, in parafrontal rows. Antenna almost reaching vibrissae; flagellum about 3 times as long as pedicel and 3 times as long as broad; arista dark brown, somewhat paler on median third, with 7-8 long rays above and 3-4 below. Palpus yellow, becoming brown, then dark brown at apex; proboscis black.

Thorax shining blue-green; three vittae of white pollen, one between the acrostichals and one between each acrostichal and dorsocentral row, before the suture, visible clearly under strongly oblique light; propleuron lightly white-pollinose; other thoracic pollen inconspicuous, visible only under strong oblique lighting. Hairs of mesonotum and scutellum scant, erect. All thoracic hairs and bristles black. Acrostichals 2,1; dorsocentrals 2,3; humerals 3; posthumeral wanting; discoscutellar 1. Coverings of anterior and posterior spiracles dark brown.

Legs simple, brown, tarsi becoming darker; coxae green exteriorly; femora with green sheen on posterior surfaces. Wings light brown, slightly darker toward costa; costal spine small. Squamae white. Halter yellow at base, otherwise brown.

Abdomen bright green; tergum 1 black medially on dorsal part; terga 2 and 3 with black posterior margins, each one-fourth to one-fifth as wide as length of segment. Tergum 2 with long median marginals and weak marginal row; 3 and 4 with strong marginal rows; 2-4 each with 1 median dorsal pair. Hairs of terga semi-appressed except at base; sterna 3-4 very densely black haired (fig. 136a). Lobes of sternum 5 reddish brown, elongated, digitate, about four times longer than wide as seen in side view (fig. 136b), moderately shining, set with hairs on its ventral surface, most of which project at right angles with the lobe. Genitalia as in figure 136c.

Length: 5.0 mm.

FEMALE. Vertex about 0.25 head width, frons widening to 0.37 across lunule. Outer verticals well developed; one proclinate and one reclinate fronto-orbital. Some short, scattered, inconspicuous setulae on frontalia. Tergum 5 undivided, arched above withdrawn genital segments.

Length: 6.0-7.8 mm.

Holotype male: Haleakala, Maui, 2,000 ft., (R. C. L. Perkins). Seven paratypes, all females, from following localities on Maui (same data as type): Nahiku, Maui, January 1908 (Terry); and Keanae, Maui, June 26, 1920 (E. H. Bryan, Jr.).

There appears to be no reliable means for distinguishing the females of this species from those of *fulgens* Grimshaw. The paratypes are presumed to be this species on the basis of distribution and association with the male.

The holotype and some paratypes are in the B. P. Bishop Museum, other paratypes in the University of Hawaii collection.

***Dyscritomyia divisa* James, new species (figs. 137a-c)**

Fitting in the "Prostethochaeta" species group near *bryani* n. sp. but is differentiated by the yellow femora, the pollinose thorax and abdomen, and by the differences in development of the fifth sternum (fig. 137b) and the male genitalia (fig. 137a).

MALE. Frons at narrowest 0.15 head width, widening to 0.18 at vertex and to 0.25 across lunule; frontalia at narrowest about two-thirds width of frons and approximately parallel-sided from anterior ocellus to lunule; parafacial about 0.08 head width at antennal bases, narrowing to 0.06, then widening toward gena. Head black, lower part (sometimes almost all) of frontale, inner margins of parafacials, and genal depression more or less extensively reddish

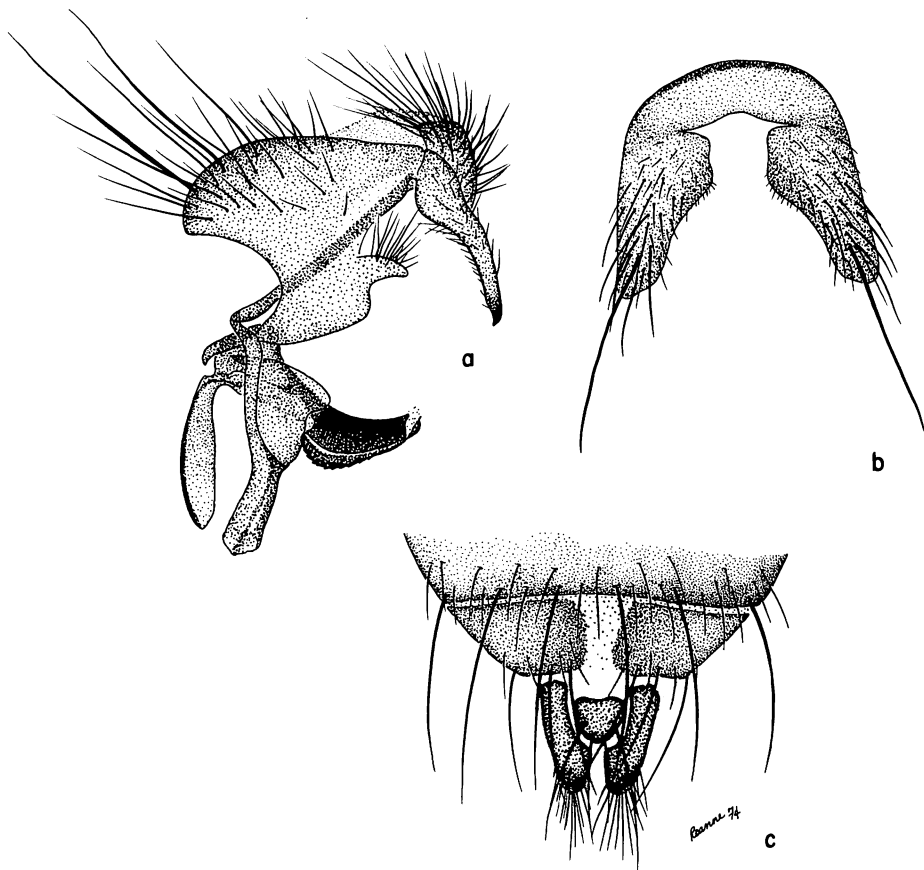


Figure 137—*Dyscritomyia divisa* James, n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral; c, apex of female abdomen showing divided 6th tergum.

brown. Outer verticals well developed but small; parafrontals 7-9, uppermost pair reclinate but in no other way differentiated and not larger than the others; some scattered hairs on parafrontals; facial ciliate on lower third. All vestiture of head black, except some yellow hairs on lower median part of occiput. Pollen white and evenly covering most of head areas but not conspicuous except on occipital orbits. Antenna almost reaching arista, brownish black, flagellum basad of arista and sometimes part of pedicel reddish brown to reddish yellow, flagellum 3.3 as long as pedicel and 3.3 as long as wide; arista brown at base, becoming yellow, then brownish black to black, rays moderately long and thickly set, about 18-20 above, 6-10 below. Palpi yellow, proboscis reddish brown to brown.

Thorax dark blue-green. Mesonotal pollen white, conspicuous on anterior slopes, notopleura, above wing base, and on pleura, especially lower areas and propleura, elsewhere clearly evident under oblique lighting. From anterior view 3 narrow pollinose vittae on mesonotum, one between acrostichal rows and one between each acrostichal and dorsocentral row. Acrostichals 2,3, dorsocentrals 3,3, first presutural of each of these rows, small; humerals 3; post-humeral present; discoscutellar, 1. Hairs of mesonotum short, erect, rather sparse, those of scutellum and pleura longer and thicker. A few hairs on propleuron. Vestiture of thorax black.

Coxae mostly bright yellow, some greenish on middle pair; femora bright yellow; tibiae yellowish brown to black; tarsi brown. Legs simple; an anterodorsal row of bristles of equal length on hind femur. Hairs and bristles of legs black except yellow ventral pubescence of anterior basitarsus. Wing uniformly pale yellowish, with yellow to brownish yellow veins; costal spine but little differentiated. Halteres yellow; squamae yellow.

Abdominal terga dark blue-green dorsally, grading to yellowish, then to bright yellow, laterally and ventrally; sterna yellow. Long median marginals on tergum 2 and marginal row on 3 and 4, long median dorsals on 2-4, long laterals on 2 and 3, short bristles connecting median marginals and laterals on 2. Abdomen wholly whitish pollinose under oblique light, much more clearly so on lateral areas of terga. Lobes of fifth sternum inconspicuous, elongated semi-oval as seen in side view; as in figure 137b as seen in ventral view. Genitalia (fig. 137a) bright yellow.

Length: 6.5-7.5 mm.; of holotype, 7.5 mm.

FEMALE. Frons at narrowest 0.25-0.28 head width. Pollen of parafacials and genae more conspicuous than in male, as conspicuous as on occipital orbits. Pregenital tergum (6th) (fig. 137c) divided into two laterally arranged plates with a membranous connection between them, the complex somewhat depressed below the apical margins of the fourth tergum, the resulting cavity being oval vertically.

Length: 7.0-9.5 mm.

Holotype male: Waianae Mts., Oahu (F. F. Illingsworth). Thirty-two paratypes, 14 males and 18 females, from following localities on Oahu: Mt. Olympus, 2,400 ft., October-November 1921-1936 (O. H. Swezey, F. X.

Williams); Oahu, no other data (J. C. Bridwell); Honolulu, Manoa Ridge, February 1916 (J. C. Bridwell); Castle Trail, Koolau Mts., 790 m., May 30, 1971 (W. C. Gagne); Poamohu Trail, Koolau Mts., August 27, 1961, (C. S. Sabrosky); Southeast Koolau Mts., 1916 (J. C. Bridwell); Kalihi; Konahuanui, trail above gap, June 17, 1917 (J. C. Bridwell); Konahuanui Trail, 2,000 ft., October 4, 1936 (F. X. Williams); Lulumahu Str., 1,900 ft., banana stem, September 17, 1936 (F. X. Williams); Pauaia, Swezey; Kaumuohona, (O. H. Swezey); Opaia, March 30, 1930 (O. H. Swezey); Lanihuli, July 18, 1928 (E. H. Bryan, Jr.); Lanihuli R., September 3, 1916 (J. C. Bridwell); Mt. Kaala, July 4, 1916 (J. C. Bridwell); Mt. Kaala, May 18, 1920 and September 26, 1920 (Swezey); east slope Mt. Kaala, 1,500–2,000 ft. (E. H. Bryan); Waianae Mts., January 5, 1952 (E. J. Ford); with larva protruding, Waikane, March 23, 1940.

The holotype and some paratypes are in the B. P. Bishop Museum, additional paratypes are in the collections of the U. S. National Museum, the University of Hawaii, and Washington State University.

***Dyscritomyia fasciata* (Grimshaw), new combination (figs. 138a–d)**

Prostheochaeta fasciata Grimshaw, 1901, Fauna Hawaiiensis 3(1):25.

Endemic. On all the major islands; the type series consists of three males from Mt. Kaala, Oahu; Halemanu, Kauai; and Halepaakai, Lanai.

Type in the British Museum (Natural History).

This is an easily recognized species, characterized by the broad, black posterior margins of the abdominal terga, the usually conspicuous white pollen of the thorax and abdomen, the presence of the posthumeral bristle, and, in the male, the narrow frons and slender, semi-oval lobes (as seen in side view) of the fifth sternum. Usually these characters may be relied upon but occasional variants should be noted. In one specimen from Palikea Gulch, Oahu, the posthumeral bristles are reduced to setulae and may easily be overlooked. A series of four males from the Kilauea Road, 22 miles from Hilo, 2,300 ft., have the thoracic and abdominal pollen reduced to the extent that, though clearly evident, it may not be considered as conspicuous as in the more typical members of the species.

An interesting gynandromorph, the only one that I have seen in this genus, in the Canadian National Collection, has the right side of the head male, the left side female, and the genitalia female. The frons is 0.17 the head width; the fronto-orbitals are well developed on the female side and lacking on the male side; the ocellar triangle is asymmetrical, the lateral ocellus being farther removed from the median one on the female than on the male side.

For a front view of the head see figure 138a. The arrangement of presutural bristles on the mesonotum is as in figure 138c. Fifth sternum of male from ventral view as in figure 138d and male genitalia as in figure 138b. The genitalia resemble those of *lucilioides* (Grimshaw) but the anterior lobes of the epanthrium are much larger, more expanded dorsally (fig. 144a).

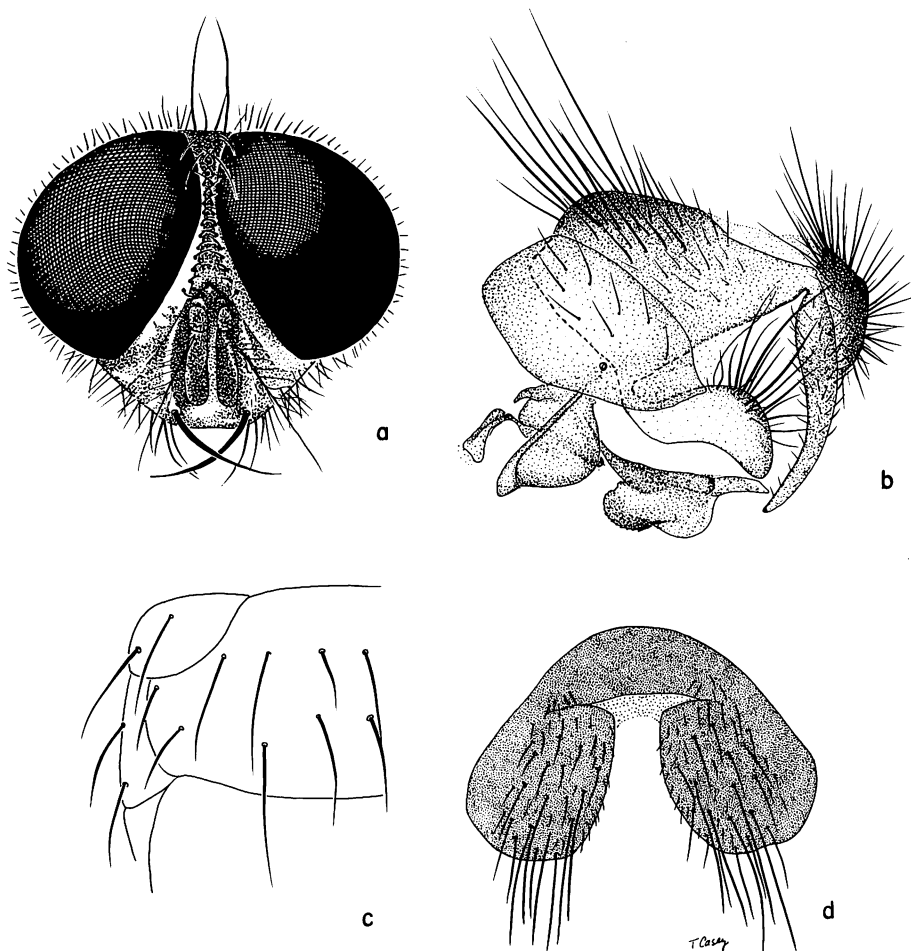


Figure 138—*Dyscritomyia fasciata* (Grimshaw): a, head of male, frontal view; b, male genitalia, lateral; c, anterior corner of mesonotum; d, fifth sternum of male.

Common on all the major islands at elevations between 1,000 and 4,500 ft.

Length: body, 7.0–9.0 mm.

D. fasciata has been collected on rotting fish, pig intestines, and human feces at Kilauea, Hawaii and taken at bait trap (meat, bananas, milk powder, and water) at Kolekole Pass, 2,000 ft., Schofield Barracks, Oahu.

***Dyscritomyia fulgens* Grimshaw (figs. 139a–c)**

Dyscritomyia fulgens Grimshaw, 1901, Fauna Hawaiiensis 3(1):23.

Endemic. Lanai (type-locality: “2,000 ft.”), Kauai, Oahu.

Type male in the British Museum (Natural History).

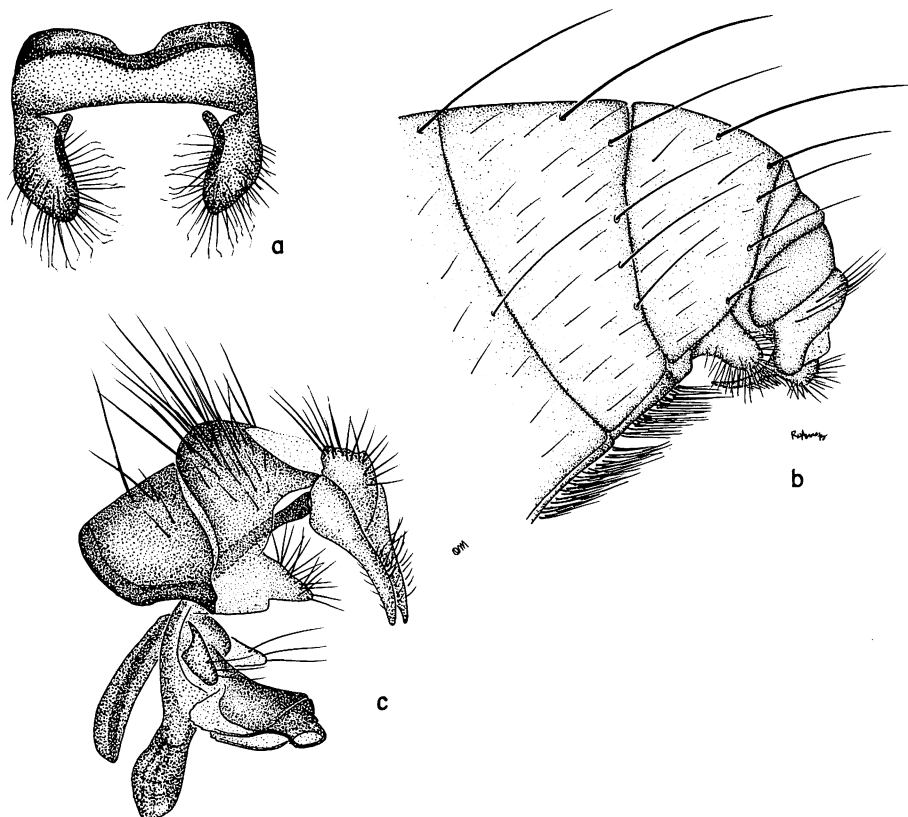


Figure 139—*Dyscritomyia fulgens* Grimshaw: a, fifth sternum of male, ventral; b, apical portion of male abdomen, lateral; c, male genitalia, lateral. [Probably equals *D. affinis* Grimshaw. D.E.H.]

This is a small species somewhat resembling *fasciata* (Grimshaw) but without the obvious pollinosity of that species and lacking the posthumeral bristle; the abdomen is a darker blue-green rather than the bright blue-green to green of *fasciata*, with the result that the posterior black margins of the terga, although as well developed, do not contrast as strongly with the remainder of the terga as in *fasciata*. The closest relationship is obviously with *affinis* Grimshaw and the two nominal species may, indeed, be synonymous.

As seen *in situ*, the lobes of the fifth sternum are broadly rounded, scarcely longer than wide (fig. 139b). From ventral view the lobes are as in figure 139a. The male genitalia are as in figure 139b,c.

[I do not believe that James examined the type or saw specimens from Lanai. The drawings were probably based upon specimens from Oahu and I feel that this is *affinis* Grimshaw; also specimens from Kauai fit this. The status of *fulgens* cannot be clarified until material is studied from Lanai, or the type is restudied. D. E. H.]

***Dyscritomyia grimshawi* James, new species (figs. 140a-f)**

Fitting in the group of species which lacks the posthumeral bristle and in the subgroup which has the wings infuscated along costal margin. Near *hawaiiensis* Grimshaw, the two are broadly sympatric and have been confused in the past. *D. grimshawi* is differentiated by having cell R_5 hyaline, rather than with basal portion, between forking of vein $R_4 + 5$ and r-m crossvein, infuscated, also the

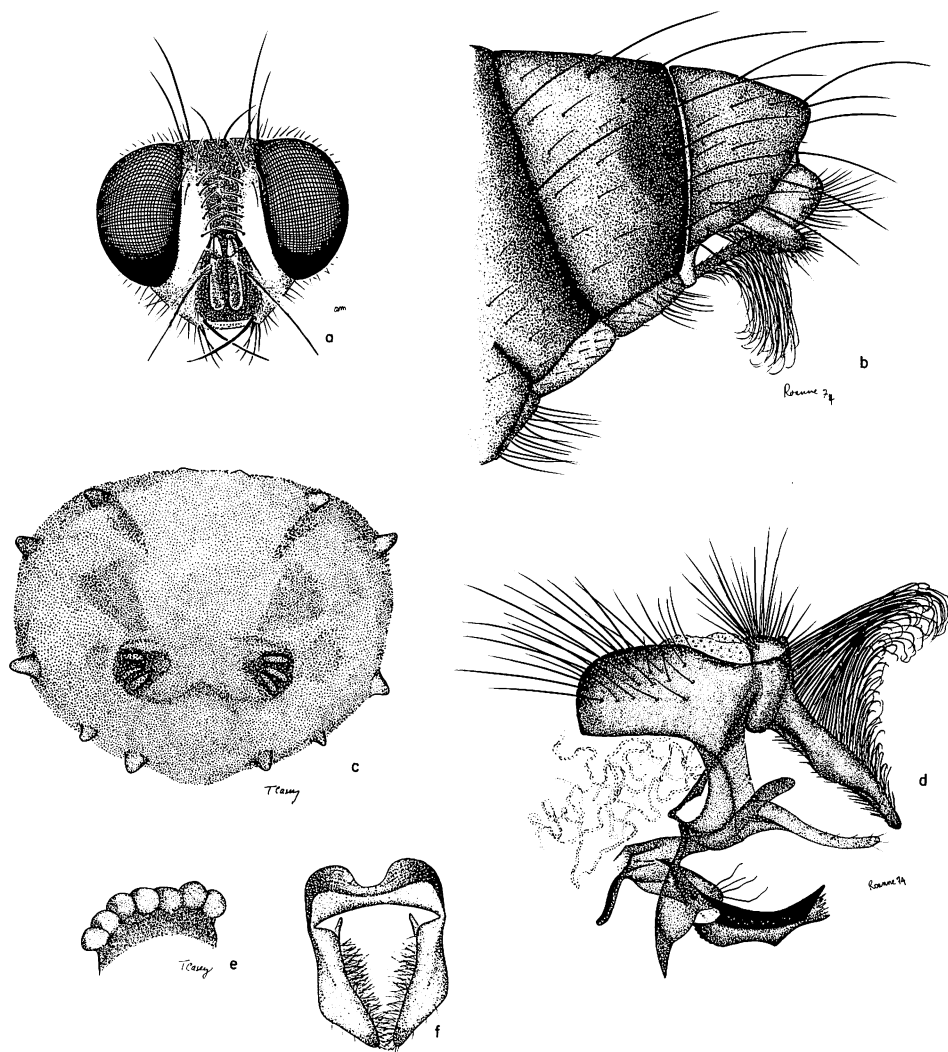


Figure 140—*Dyscritomyia grimshawi* James, n. sp.: a, head of female, frontal view; b, apical portion of male abdomen, lateral; c, posterior end of third instar larva; d, male genitalia, lateral; e, anterior spiracle of third instar larva; f, fifth sternum of male, ventral.

development of the fifth sternum (figs. 140f, 141c) and the male genitalia (figs. 140d, 141d) differ strikingly in these.

MALE. Frons at narrowest 0.18 head width, widening to 0.25 at vertex and 0.33 across lunule. Frontalia well developed throughout, narrowing to 0.10 width of head at about mid-point between anterior ocellus and lunule and almost parallel-sided on lower half. Parafrontals and parafacials strongly protruding forward, from side view 0.18 head width, narrowing to 0.12 at anterior tentorial pit; middle of face shallowly concave, merging into epistoma. Occipital orbit narrow. Head black; parafacials, parafrontals, except above, and occipital orbits, except above, densely silvery pollinose; parafrontals and occipital orbits becoming only lightly pollinose and then subshining; frontalia opaque, with black velvety pollen above. Outer verticals stronger but usually not longer than upper setulae of the occipital fringe, latter with gradually lengthening hairs which are quite long on the upper part; parafrontals 14-16, lowermost one to several pairs cruciate, becoming gradually longer toward vertex, the uppermost reclinate. Facials with setulae and fine hairs on lower third. Some hairs on vertex and upper parafrontals, sometimes a few setulae in parafrontal rows; densely pollinose areas bare. All hairs and bristles of head black, except a small divided tuft of appressed yellow hairs on occiput just above neck. Antenna black, reaching upper margin of epistoma and ending well above vibrissa; flagellum about three times length of pedicel and about three times as long as wide. Arista brown to black at base, becoming paler in color beyond basal third; plumose only on basal half to three-fifths, with 8 to 10 long rays, sometimes fewer, and some short setae above, 5 to 8 long rays and usually some short setae below. Palpus long and slender, slightly enlarged apically, blackish-brown to black; proboscis black.

Thorax green, almost black, with coppery to purplish reflections, especially dorsally. Pile of mesonotum erect, moderately dense and well distributed over its surface as well as on scutellum, mesopleuron except lower part, and upper parts of sternopleuron; mesonotal hairs as long as lower parafrontal bristles, those of pleura somewhat longer; thoracic hairs and bristles black. Covering of anterior spiracle brownish-black. Middle of propleuron with some fine, erect hairs. Pollen of mesonotum visible only under strongly oblique light. Acrostichals 2, 1-2, dorsocentrals 2-3, 2, first presutural of each series sometimes weak; humerals 2; posthumeral absent; discoscutellar 1.

Legs black, fore and middle coxae black to greenish black; inner surface of anterior coxa bare but distinctly whitish-pollinose, legs otherwise with black hairs and bristles. Front femur with well-marked dorsal and posteroventral rows and with scattered bristles and bristle-like setae between them which do not form any clearly marked rows; middle femur with bristles of anteroventral row longer than those of posteroventral; hind tibia with 3 or more anterodorsals and 2 to 3 posterodorsals. Legs simple. Wings lightly infuscated, becoming more strongly and distinctly so at base and along costal margin, including cells C, Sc, R₁ at least to apex of Sc; the deeper infuscation not extending into apical parts of cells R and R₁ as it does in *hawaiiensis*. Costal spine as long as

width of cell 2nd C. Squamae and their fringes white. Halteres small, yellow, knob darkened.

Abdomen dark green or blue-green to greenish black; broad posterior margins of terga indistinctly black to blackish and seen best under oblique lighting. Tergum 2 with strong, long, median marginals and weaker marginal row; 3, with marginal row; 2 and 3, each with one or two median dorsal pairs; 4, with irregular median dorsal and median marginal rows. Bristles, setulae, and hairs black; terga with regularly spaced and abundant semi-erect hairs, a little shorter than those of thorax; sterna well exposed, the second and apex of fourth with erect, bristle-like setae, the third bare. First hypopygial tergum narrow, fused with second laterally, lobes of fifth sternum elongated-oval as seen *in situ* (fig. 140b), about twice as long as wide, rounded apically, with only short, inconspicuous hairs. Surstyli (posterior lobes of epandrium) each bearing a very conspicuous dorsal clump of long, black hairs which in the unspread genitalia appear as a prominent tuft extending forward between the lobes of the fifth sternum (fig. 140b). Other details of genitalia as in figure 140d. Fifth sternum as in figure 140f.

Length: 5.5–8.5 mm.; of holotype 8.0 mm.

FEMALE. Frons narrowest at vertex (fig. 140a), there 0.33 head width, widening to 0.40 across lunule. Frontalia at antennal bases as broad as each parafrontal, becoming much broader toward vertex, and bearing some short black hairs above. Outer verticals well developed; 1 reclinate and 2 proclinate fronto-orbitals; lower frontals not cruciate; upper setulae of occipital fringe longer than the others. Bristles of legs less prominent than in male. Tergum 5 simple, entire, arched dorsally; fourth and fifth sterna broadly exposed, flattened, simple.

Length: 5.5–9.5 mm.

Irregularity. One female, not a paratype but topotypical, has a strong posthumeral developed on one side; the topotypical males and other females are normal in this respect.

Posterior end and anterior spiracle of third instar larva as in figures 140c and e.

Holotype male: Haleakala, Maui, August 26, 1918 (H. Swezey). Approximately 100 paratypes, both sexes well represented from the following localities. Maui: Same as type, July 28, 1907; and summit, July 29, 1907 (F. W. Terry), August 25 and 26, 1918 (O. Bryant); 9,000 ft., January 2, 1915 (J. F. Illingsworth); 8,000–9,000 ft., August 14, 1927 (J. C. Bridwell), March 19, 22, 23, 25, 1932 (O. Bryant); and 2,200 m., on dried meat, February 6, 1964 (D. M. Tsuda). Also, Haleakala Road, March 15, 1931, *Styphelia douglasii* (L. W. Quate); Halemau Trail, Haleakala, September 13, 1968 (J. A. Tenorio); Kapalaoa, Haleakala, 7,200 ft., August 3, 1971 (D. E. Hardy); Holua, Haleakala Crater, 6,500 ft., June–August 1953–1970, (J. W. Beardsley and D. E. Hardy); Holua, Cabin Exit Trail, sweeping, September 13, 1968 (G. K. Kobayashi); Paliku, Haleakala Crater, June 1953–August 1958 (D. E. Hardy and C. R. Joyce); Puu Nianiau, 7,000 ft.,

July 1956 (D. E. Hardy); Kapaloa, in cabin, October 25, 1956 (J. L. Gressitt); Kula Pipe Line, 4,500 ft., April 3 and 15, 1932 (O. Bryant); Kaupo Gap, 5,000 ft., August 4, 1971 (D. E. Hardy). Hawaii: Mauna Loa, Summit Trail, 8,000 ft., March 17, 1973 (D. Fujii and D. E. Hardy); Hualalai Mts., 6,000–7,000 ft., August 1, 1929 (F. X. Williams), April 21, 1944 (N. L. H. Krauss), and January 22, 1972 (F. G. Howarth); Kilauea, Waiakea Forest, 1,740 m., March 18, 1961 (L. W. Quate); Kilauea, 6,500 ft., July 17, 1945, by beating (F. A. Bianchi); Mauna Loa, 1,980 m., March 20, 1961 (L. W. Quate), one on *Styphelia tameiameia*; Kona, 6,000 ft., August 30, 1892 (R. C. L. Perkins), Fauna Hawaiiensis Collection; Puu Kili, 7,000 ft., Pohakuloa, June 17, 1971 (S. L. Montgomery). Specimens have been attracted to rotting meat.

The holotype and numerous paratypes are in the B. P. Bishop Museum; other paratypes are in the Canadian National Collection and the collections of the U.S. National Museum, the University of Hawaii, and Washington State University.

Dr. F. G. Howarth collected adults feeding on dead earthworms on trail from Paliku cabin, Haleakala Crater, June 23, 1976.

***Dyscritomyia hawaiiensis* Grimshaw (figs. 141a–d)**

Dyscritomyia hawaiiensis Grimshaw, 1901, Fauna Hawaiiensis 3(1):22.

Endemic. Hawaii (type-locality: Kona, 4,000–6,000 ft.), Lanai, Maui. Common, at least on Hawaii.

Type in the British Museum (Natural History).

This species resembles *limbipennis* Grimshaw and *grimshawi* n. sp. The brown anterior border of the wing is not interrupted by the yellow area at the base, as in *limbipennis*, and it is more extensive than in either of the above species, extending to the apex of cell R₁, and filling the basal section of cell R₅ before the r-m crossvein. The male genitalia differ considerably in the three species. Despite the very different type of genitalia, *D. grimshawi* has been confused with *hawaiiensis* in the past.

The female head as seen in frontal view is as in figure 141a. The presutural bristle arrangement of the thorax as in figure 141b, the fifth sternum as in figure 141c, and the genitalia as in figure 141d.

This is one of the ground-inhabiting species and is evidently a scavenger on other insects. One adult female was reared from the body of a sphinx moth which had been purposely torn open and exposed on the ground where the flies had been seen alighting (Lanaihale, Lanai, 3,800 ft., October 1976, S. L. Montgomery).

***Dyscritomyia lata* James, new species (figs. 142a–c)**

Fitting in the "Prosthetochaeta" species group running near *fasciata* (Grimshaw) and *obscura* (Grimshaw) but differing by being more robust; lacking distinct dark posterior margins on terga; having the lobes of fifth sternum

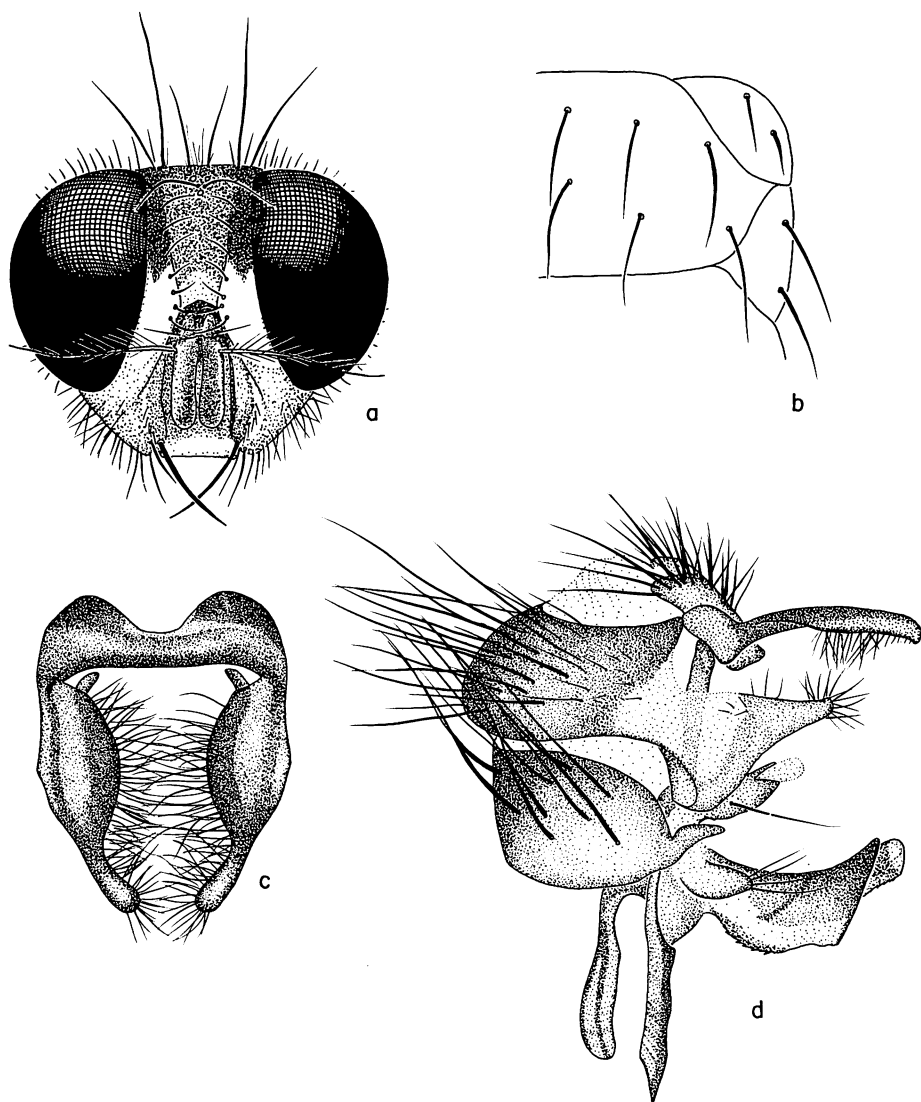


Figure 141—*Dyscritomyia hawaiiensis* Grimshaw: a, head of female, frontal view; b, anterior corner of mesonotum; c, fifth sternum of male; d, male genitalia, lateral.

pointed apically and differently shaped (figs. 142a,b) and the surstyli each with a strong apicoventral tooth (fig. 142c).

MALE. Frons at narrowest 0.07 head width, widening to 0.13 at vertex and 0.22 across lunule, frontalia at narrowest about width of parafrontal at same level, then widening to ocellar triangle and strongly widening below; para-facial at antennal base about 0.10 head width, almost parallel-sided on upper

half, then widening toward gena. Head black, tending to brownish on genal depression and toward oral margin. Parafrontals, parafacials, facials, middle of face, genae, and occipital orbits thickly white-pollinose; pollen of parafrontals becoming dark gray toward vertex, that of frontalia reddish brown. Outer verticals present but slender; parafrontals 13-15, slender, uppermost pair somewhat stronger and reclinate; parafrontals with a row of inconspicuous setulae; parafacials bare; facials ciliate about one third way upward from vibrissae. Hairs of occiput yellow medially and below; all hairs, setulae, and bristles of head otherwise black. Antenna dark brown; flagellum long and slender, about 3.5 as long as pedicel and 4.5 as long as wide, reaching almost to level of vibrissa; arista brown, becoming yellow beyond basal fourth and then brown again; rays long, about 25 above and 12 below. Palpi yellow, becoming brownish toward apex; proboscis brownish black.

Thorax dark blue-green; white pollen clearly evident on anterior slopes of mesonotum and on lower parts of pleura, especially sternopleura, less conspicuous pollen evident elsewhere under oblique lighting. Setulae short, well distributed over mesonotum but not dense, those of pleura tending to be longer. Vestiture of thorax black. Acrostichals 2,2-3; dorsocentrals 2-3,3; humerals 3; posthumeral present; discoscutellar 1, feeble. Postalar wall with 2-4 hairs on posterior part. Coverings of anterior and posterior spiracles dark brown.

Front coxa green with conspicuous white pollen; middle coxa green in part; legs otherwise brown to dark brown, femora with distinct green reflections. Legs simple in structure and with only ordinary hairs and setulae; pubescence on ventral surface of front and hind tarsi and of apical half of front tibia reddish-brown. Setulae and bristles of legs black. Hind tibia with a sparse row of 5 to 6 short anterodorsals which includes, in addition, a stout, long, median one. Wing uniformly pale brown, subhyaline; $R_4 + 5$ ciliate about two-fifths way to r-m. Squamae light brown.

Abdomen broad, oval, distinctly broader than thorax; dark blue but with distinct purple reflections, terga distinctly and densely white-pollinose ventrally, otherwise clearly pollinose under oblique lighting. Median marginals lacking on first tergum; strong median marginals and otherwise a weak marginal row on 2, strong marginal row on 3 and 4; no outstanding lateral marginals on 1; median dorsals on 2 and 3; median dorsal row and, in addition, smaller scattered median dorsals on 4. All abdominal vestiture black; setulae mostly appressed dorsally, erect to semi-erect laterally and ventrally. Sterna with only ordinary setulae. Genitalia small; lobe of fifth sternum (figs. 142a,b) small and not strongly projecting ventrally, but with an umbo anteriorly; genitalia otherwise as in fig. 142c.

Length: 9 mm.

FEMALE. Unknown.

Holotype male: Olaa, Hawaii, 2,500 ft. (W. H. Ashmead). One paratype male, same data. The holotype and paratype are in the collection of the U.S. National Museum, type no. 72553.

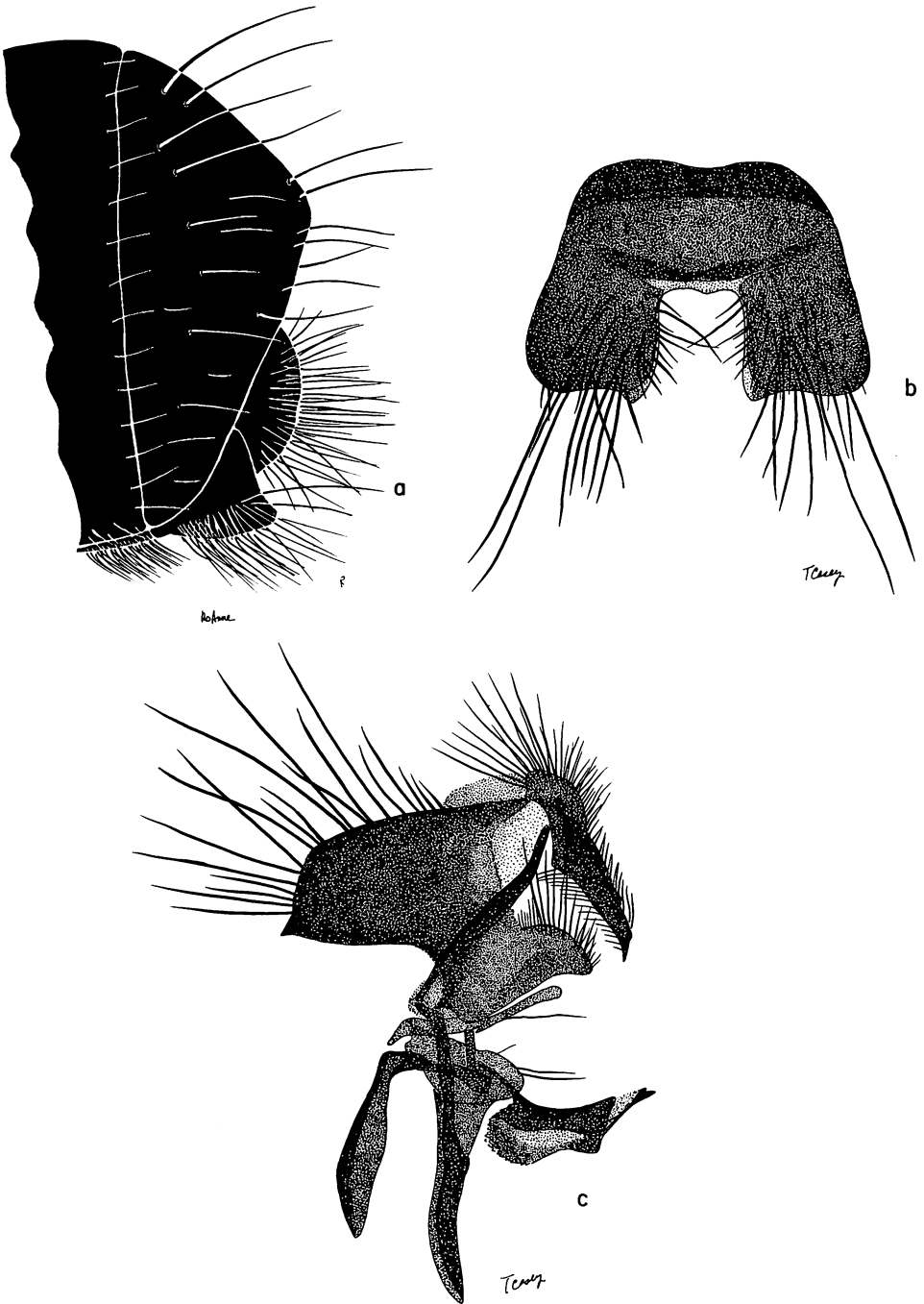


Figure 142—*Dyscritomyia lata* James, n. sp.: a, apex of male abdomen, lateral; b, fifth sternum of male, ventral; c, male genitalia, lateral.

***Dyscritomyia limbipennis* (Thomson) (figs. 143a-d)**

Catapicephala limbipennis Thomson, 1869, K. svenska fregatten Eugénies Resa, Zool., Dipt. 2:541.

Dyscritomyia limbipennis (Thomson), Grimshaw, 1901, Fauna Hawaiiensis 3(1):22.

Endemic. Oahu (type-locality: Honolulu), Kauai, and ?Molokai.

Type in the British Museum (Natural History).

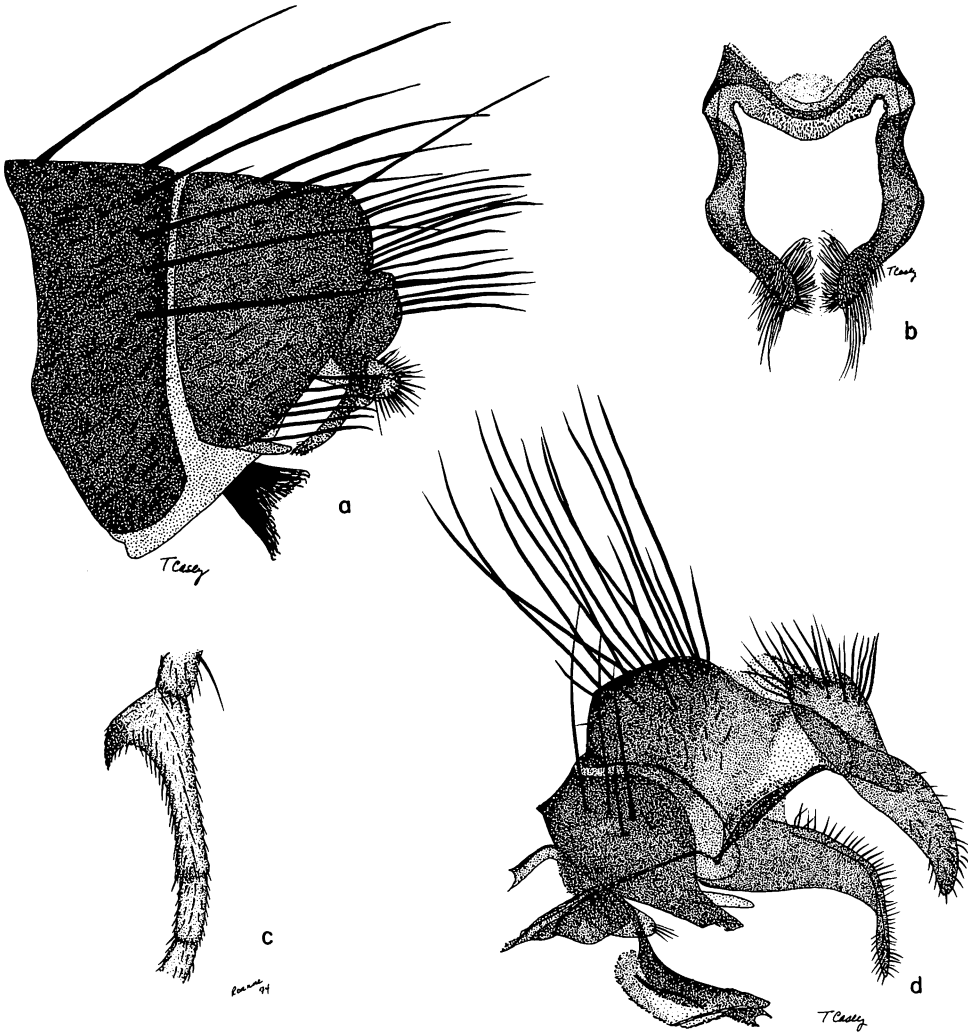


Figure 143—*Dyscritomyia limbipennis* (Thomson): a, apical portion of male abdomen, lateral; b, fifth sternum of male, ventral; c, front basitarsus of male; d, male genitalia, ventral.

This species was described from a female but Grimshaw was most probably correct in associating the males from the Waianae Range, Oahu, with it. I have seen both males and females from Mt. Tantalus and "Honolulu mountains," one or both of which might have been at least close to the type locality. Grimshaw's identification of two females from higher elevations in Molokai is probably correct but must be considered as tentative until these records are confirmed by the capture of males from that island.

Fitting in the species group which lacks the posthumeral bristle and in the subgroup which has the wings infuscated along costal margin. It is characterized by the males having a short, robust, sharp, curved spur on underside of front basitarsus (fig. 143c) as well as by the characteristics of the fifth sternum (fig. 143a,b) and the male genitalia (fig. 143d).

The frons of the male at narrowest point is about equal in width to 15 rows of eye facets. The bristles of the abdomen are unusually strong and conspicuous.

The clouding of the anterior part of the wing is interrupted by a distinct yellow area at the base, which usually contrasts sharply with the brown clouding of the rest of that border. The lobes of the fifth sternum are three times longer than wide, inconspicuously haired (figs. 143a,b). The lobes from the anteroventral portion of the epandrium are strongly curved downward (fig. 143d).

Length: body, 7.5 mm.

***Dyscritomyia lucilioides* (Grimshaw), new combination** (figs. 144a, b)

Prostethochaeta lucilioides Grimshaw, 1901, Fauna Hawaiiensis 3(1):25.

Endemic. Hawaii (type-locality: holotype male, Olaa; 1 female, Kilauea).

Type in the British Museum (Natural History).

This is one of the most common species on the island of Hawaii, to which it is limited and where it occurs particularly at elevations over 2,000 ft. It is broadly sympatric with *D. obscura* (Grimshaw), less so with *similis* n. sp., which also is restricted to the Big Island. The three form a closely related complex, the status of which is hard to determine. Typical members of the three are easily distinguishable; there are no intergrades so far known between *similis* and the other two species but intergrades between *lucilioides* and *obscura* are common and puzzling. This fact should be taken into account when one uses the key. Male genitalia are of the same type in all three. The sympatric and synchronic nature of the elements of this complex preclude the possibility that they are subspecies of a polytypic species. Until the situation can be more thoroughly studied, the best interpretation is that this is a complex of three very closely related species, which probably differentiated from one another before subsequently coming together again in their geographical range, after which time two of the elements began to interbreed, thus producing intermediates.

Fifth sternum and male genitalia as in figures 144a,b.

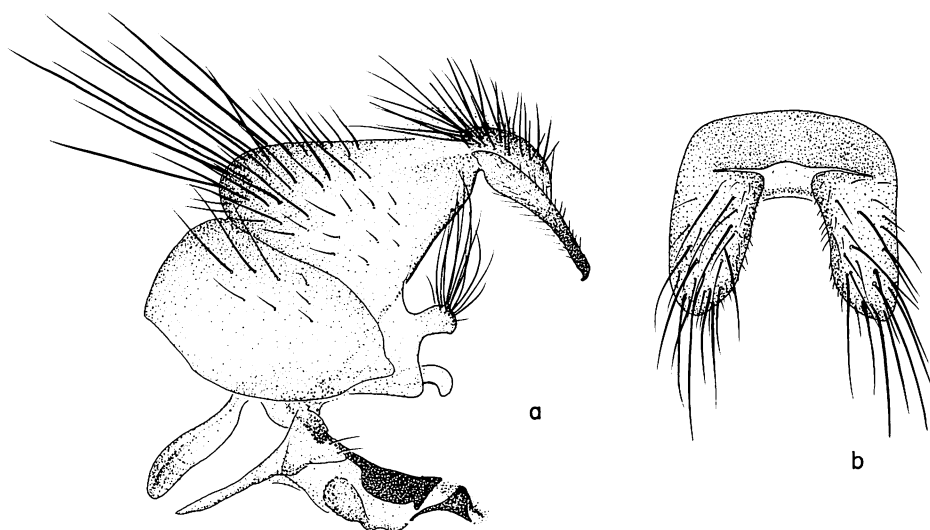


Figure 144—*Dyscritomyia lucilioides* (Grimshaw): a, male genitalia, lateral; b, fifth sternum of male, ventral.

Length: body, 7.0–8.5 mm.

The following table gives the differences between *lucilioides* and *obscura*.

<i>lucilioides</i>	<i>obscura</i>
Facialia silvery-pollinose	Facialia brown-pollinose, often with yellowish brown reflections
Palpi usually pale	Palpi dark brown to black
Anterior spiracle usually yellow-haired.	Anterior spiracle black-haired
Front femur extensively yellow	Front femur black with green reflections
Middle and hind femora mostly yellow	Middle and hind femora often wholly black with green reflections
Squamae whitish to pale yellow	Squamae brownish to dark brown
Abdomen yellow at base, otherwise bright green or coppery green to dark green	Abdomen dark bluish green, usually not yellow at base
Male genitalia tending toward yellow, may be wholly so externally	Male genitalia tending toward black or metallic green, may be predominantly so externally

Specimens have been attracted to crushed snails, rotting fish, human feces and to brewers yeast bait.

***Dyscritomyia nigerrima* James, new species (figs. 145a-c)**

Fitting in the species group which lacks the posthumeral bristle and in the subgroup which has the wing infuscated along costal margin. It is differentiated by having the abdomen black, with green sheen only on sides; having three humeral bristles; and the parafacials distinctly narrower than distance between vibrissae.

MALE. Frons at narrowest 0.17 head width, widening to 0.20 at vertex and 0.30 across lunule; frontalia at narrowest about 3 times width of each parafrontal, almost parallel-sided from antennal bases to ocellar triangle; parafrontal consequently broadening to a maximum at antennal bases, where it is a little broader than the frontale, parafacial then narrowing toward gena, where it is about 0.75 maximum width. Head black; lower half of parafrontals, parafacials, facials, and occipital orbits densely silvery-pollinose; middle of face less brightly so. Frontale with velvety brownish black pollen which appears a brighter brown under oblique light. Vertex subshining, genae shining. Parafrontals well developed, 11-12; outer verticals present but small; ocellars presumably small (as indicated by scars); facial cilia, only feeble hairs except just above vibrissae. Parafrontals bare except near vertex; parafacials bare;

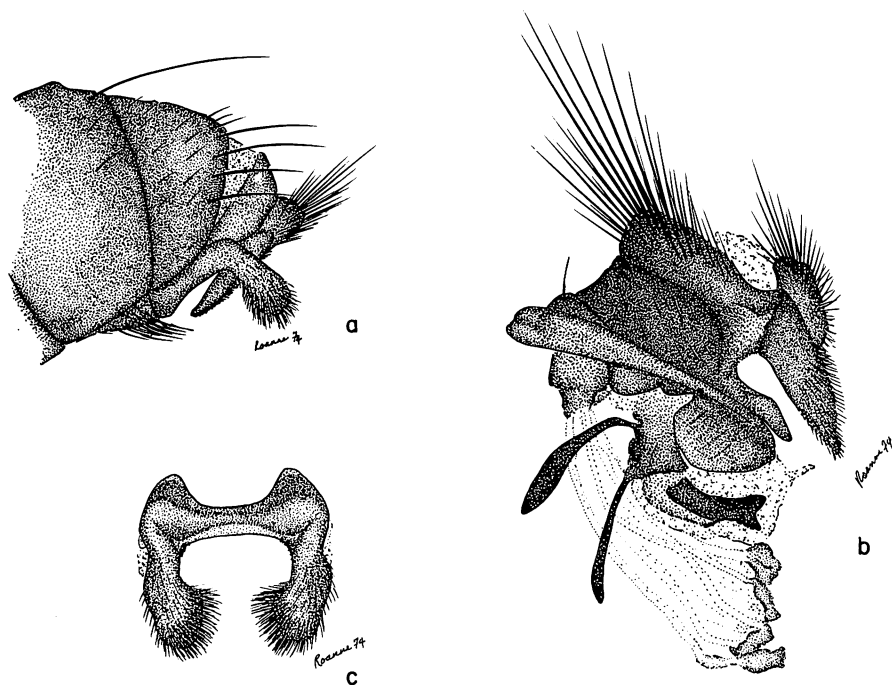


Figure 145—*Dyscritomyia nigerrima* James, n. sp.: a, apical portion of male abdomen, lateral; b, male genitalia, lateral; c, fifth sternum of male.

frontalia with only a few scattered setulae. Vestiture of head wholly black. Antenna black, apex of pedicel and median third of arista reddish brown; flagellum broad, about 3.5 as long as pedicel and 3.5 as long as wide, extending close to but ending distinctly above vibrissa. Palpi slender, dark brown; proboscis black.

Thorax black dorsally with green to purplish reflections under certain lights; pleura dark green. Pollen scant but visible under oblique lights. Setulae short and inconspicuous but well distributed over dorsal and upper pleural areas. Coverings of anterior and posterior spiracles black. Postalar wall bare. Humerals 3; posthumeral lacking; acrostichals 2,1; dorsocentrals 2,3; lateral basal scutellar 1; discoscutellar 1.

Legs simple; coxae dark green; femora black with strong green reflections posteriorly; tibiae and tarsi black; front tibia and basitarsus yellowish brown on anteroventral surface and with short, dense, brown pubescence there, hairs and bristles of legs otherwise black; hind femur with long hairs on anteroventral, ventral, and posteroventral surfaces, becoming much longer than diameter of femur toward its apex, the extreme apex, however, narrowing rapidly and with or without these hairs; a row of strong anterodorsals on apical two-thirds. Wing light brown, anterior part including extreme base and cells C, Sc, R, R₁ except extreme apex, and most of R₃ densely infumated; R₄ + ₅ ciliated halfway to r-m. Squamae white, halter brown.

Abdomen black, more intensively so at apices of terga; terga 1 and 2, laterally with dark green reflections, terga 3 and 4, both dorsally and laterally with coppery reflections under certain lights. Bristles and hairs all black; median marginal and strong lateral on tergum 1, median dorsals on terga 2 and 3, marginal row on 2 to 4, median pair in row of 2 and 3 much the longest and strongest; setulae rather thick but short, erect to semi-erect on tergum 1 and sides of other terga, elsewhere appressed. Sterna simple; 3 and 4 largely bare or with sparse hairs medially, each, however, conspicuously hairy on apical third (sternum 3) or fourth (4), these hairs much longer on lateral third than medially, those of sternum 4 forming a dense, erect, transverse apical band, the median hairs of which are as long as the longest on sternum 3, the lateral ones very long and tending to be crinkly toward apices. Lobes of fifth sternum elongated-oval, projecting strongly ventrad (fig. 145a); except at base, thickly clothed with soft, crinkly hairs (fig. 145c). Genitalia as in figure 145b.

Length: 9 mm.

FEMALE. Unknown.

Holotype male: Kauai, 2,500 ft., April 8, 1919 (J. A. Kusche). The holotype is in the U. S. National Museum, type no. 72555.

***Dyscritomyia obscura* (Grimshaw), new combination (figs. 146a-c)**

Prostethochaeta obscura Grimshaw, 1901, Fauna Hawaiensis 3(1):25.

Endemic. Hawaii (type-locality: Kona, 4,000 ft.).

Type female in the British Museum (Natural History).

My first inclination was to synonymize this species with *lucilioides* (Grimshaw) but it is being maintained as separate because typical specimens are so easily distinguishable from that species. In *obscura*, the body and legs are noticeably darker and the squamae are distinctly brown, more intensely so in the male than in the female. The fifth sternum of the male and the male genitalia are as in figures 146a and b and the pregenital tergum and ovipositor of female as in figure 146c.

Length: body, 6.5–8.0 mm.

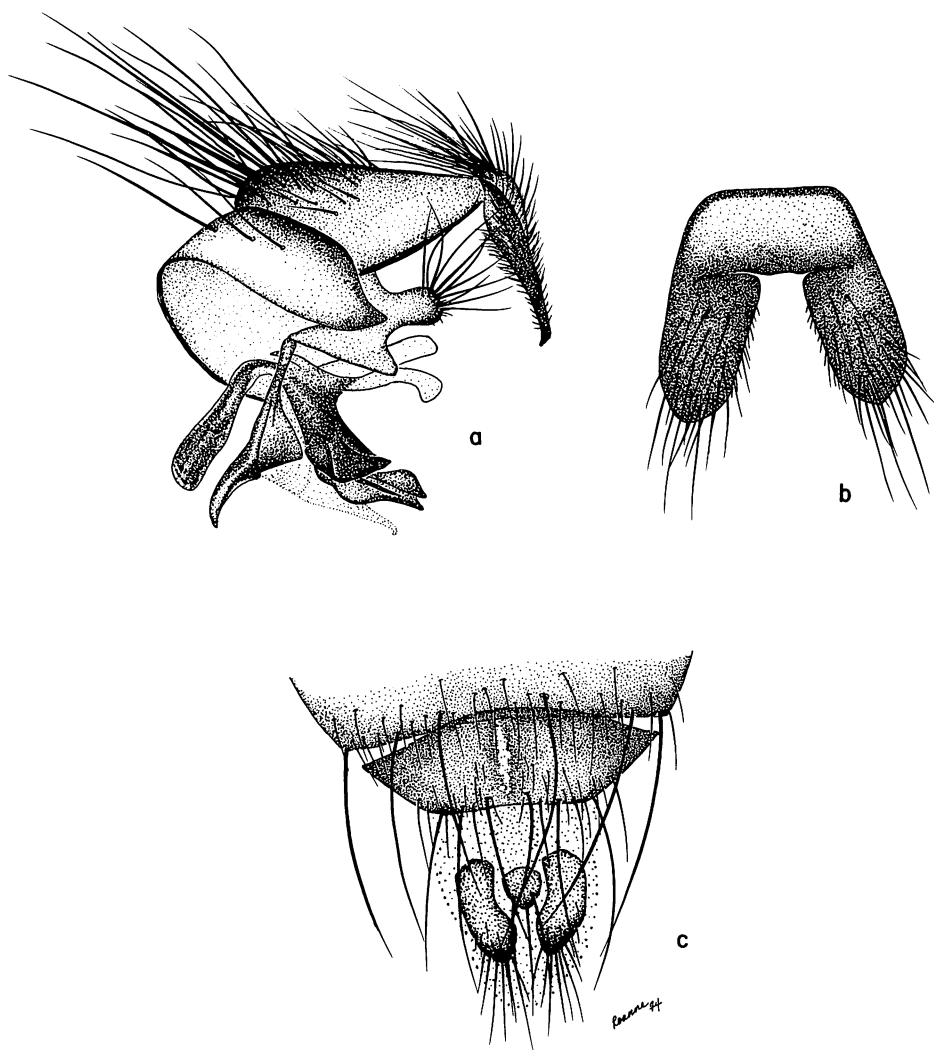


Figure 146—*Dyscritomyia obscura* (Grimshaw): a, male genitalia, lateral; b, fifth sternum of male, ventral; c, pregenital tergum and ovipositor of female, dorsal.

***Dyscritomyia pectinata* James, new species (figs. 147a-d)**

D. pectinata and *sternacantha* n. sp. fit in a special species complex of the group which lacks posthumeral bristles and which has the wings infuscated along costal margin. They are very distinctive from other known *Dyscritomyia* by having the abdomen unusually deep (high) in relation to its width; by having the mid femora of males densely haired ventrally (figs. 147d, 152c); the fourth sternum of male with strong apical spines (figs. 147c, 152d); the fifth sternum developed into a median lobe and with the apodemes asymmetrical, more greatly developed on the left side (figs. 147b, 152b); also the surstyli (posterior lobes of epandrium) very different in development from other *Dyscritomyia* (figs.

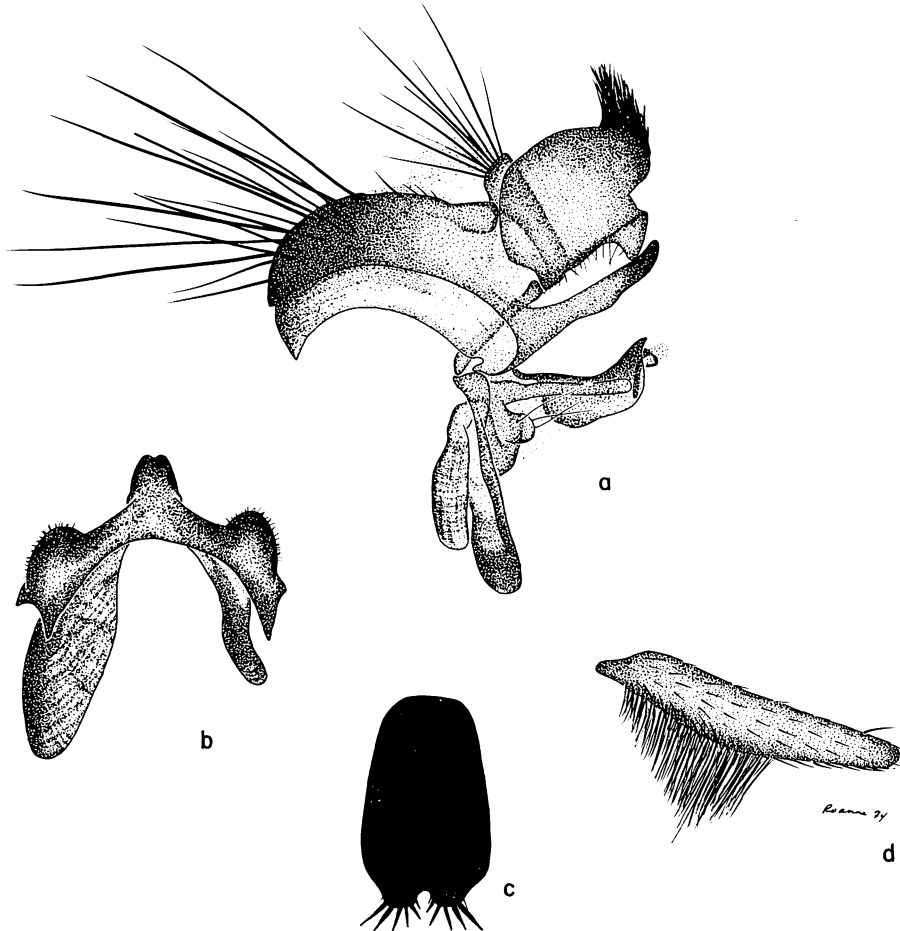


Figure 147—*Dyscritomyia pectinata* James, n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral; c, fourth sternum of male, ventral; d, mid femur of male.

147a, 152a). The two are readily differentiated by the nature of the sterna and the male genitalia.

MALE. Width of frons at narrowest, 0.20 head width, widening to 0.30 at vertex and 0.26 across lunule. Frontale about half width of frons, widening as the frons widens above and below; parafacial at antennal bases about 0.12 head width, narrowing to 0.8 at gena. Head black, genal depression brown; pollen white, that of frontale with a yellowish tinge; densest on the occipital orbits, rather dense on parafacials and middle of face, sparser on parafrontals which become subshining above. Some small hairs on parafrontals and upper parafacials. Bristles and hairs of head black, except for some hairs on occiput just under neck. Pile of occiput stiff. Outer verticals distinct but small; 8 to 10 frontals, the uppermost a little longer and reclinate, the others, all long and strong but decreasing a little anteriorly. Antenna almost reaching vibrissae; flagellum 3.3 as long as pedicel and 4.0 as long as wide. Arista brown, a little paler medially; about 10 rays above and 4 below. Palpus brown, proboscis black.

Thorax blue-green to blackish green, with or without coppery reflections; pale pollen evident under oblique lighting except on upper parts of pleura. Pile moderately abundant, erect, black, including that of propleuron; that of prescutellar area, scutellum, and pleura, especially above, longer than that of most mesonotum. Acrostichals 2,1, dorsocentrals 2,3, the first of each series very short but distinct; humerals 2; posthumeral lacking; discoscutellars 1.

Legs dark brown to black, femora with a metallic green sheen. Middle femur greatly thickened basally and with hairs and bristles as in *sternacantha*, the brush of hairs somewhat shorter than in that species but still noticeably long (fig. 147d). Hind femur as in *sternacantha*. Wing brown anteriorly; however, at base, somewhat less intensively so than in *sternacantha*. Costal spine a little shorter than width of subcostal cell. Squamae pale yellow to yellow; halter brownish yellow to brown.

Abdomen deep, conical, almost as deep as wide at base; mostly blue-green to green, with or without coppery reflections; first tergum, dorsally and at the base, laterally, also posterior margins of terga 2 and 3, black; pollen noticeable only at base, even under oblique lighting. Median marginals, laterals, and weak median row on tergum 2, marginal rows on 3 and 4, and median dorsals on 2-4. Abdomen with short black setulae, regularly distributed over most of its surface, longer laterally. Tergum 4 incised U-like at apex; sternum 4 projecting strongly ventrad and bearing at its apex a comb of short, stiff, setulae in two groups, 5 on each side (fig. 147c); sternum 5 produced into a narrow digitate median lobe (fig. 147b). Surstyles very broad, leaf-like, directed ventrad, terminating in a dense clump of closely-appressed, stiff, hairs, which, at first glance *in situ*, give the impression of being a recurved spine. Genitalia otherwise as in figure 147a.

Length: 8.0 (holotype) to 9.0 (paratype) mm.

FEMALE. Fitting the male except for the slightly wider frons, lack of ornamentation on legs, and sexual characters.

Holotype male: near Kahua Ranch, Kohala, Hawaii, 4,000 ft., September 4, 1936 (E. Y. Hosaka). One paratype male, Kau, Hawaii, 4,000 ft. (R. C. L. Perkins).

The holotype in the B. P. Bishop Museum; the paratype in the University of Hawaii collection.

***Dyscritomyia retracta* James, new species (figs. 148a-d)**

Fitting in the "Prostethochaeta" species group, closely related to *caudata* n. sp. but with the genitalia metallic black with anterior lobe of epandrium and the lobes of fifth sternum densely long haired (figs. 148a,b).

MALE. Frons, at narrowest, 0.07-0.08 head width, widening to 0.15 at vertex and 0.25 across lunule; frontale evident throughout; parafacial at antennal base 0.08 head width, almost parallel-sided, then widening to 0.10 below. Head black, may be reddish brown in part on lower frontale and genal depression. Occipital orbits, genae, parafacials, and lower parafrontals with moderately dense white pollen, more yellowish on parafacials; upper parafrontals becoming subshining; facials and middle of face with less dense white pollen; frontale with velvety blackish pollen which appears pale under oblique lighting. Outer verticals not developed; parafrontals, 12-14, uppermost pair somewhat longer than others and reclinate; some parafrontal hairs within the bristle row and an irregular row of hairs outside it; facialia with setae limited to lower third. Vestiture of head black, at most some yellow hairs on occiput below neck. Antenna reaching almost to vibrissa, dark brown to black; flagellum 3.5 length of scape and 3.5 as long as wide; arista brown at base, then yellow, becoming brown to black on apical half; about 12 to 15 long rays above and 8 to 10 below. Palpi yellowish brown to light brown, becoming dark brown to blackish brown on enlarged apical part; proboscis dark brown to black.

Thorax blue-green, in places with purplish reflections; a narrow purplish strip before suture between each acrostichal and dorsocentral row. Sheen of thorax, especially mesonotum, dulled by white pollen, which is best seen by oblique lighting but may be visible directly. Hairs of mesonotum short, erect, well distributed over its surface; propleuron with fine hairs; vestiture and bristles of thorax black. Acrostichals 2,2, dorsocentrals 3,3, first of each presutural series variably weak or strong; humerals 3; posthumeral present; discuscutellar 1. Coverings of anterior and posterior spiracles dark brown to black.

Legs simple, dark brown to black, with greenish sheen in places, especially on femora; vestiture black except pads on front and hind basitarsi, which are golden brown. Wing pale brownish yellow, color gradually fading toward posterior margin; costal spine small. Squamae tinged with brown; halteres light brown.

Abdomen green, dulled with white pollen, which is best visible under oblique lighting; tergum 1 black, 2-4 with narrow posterior black borders, about

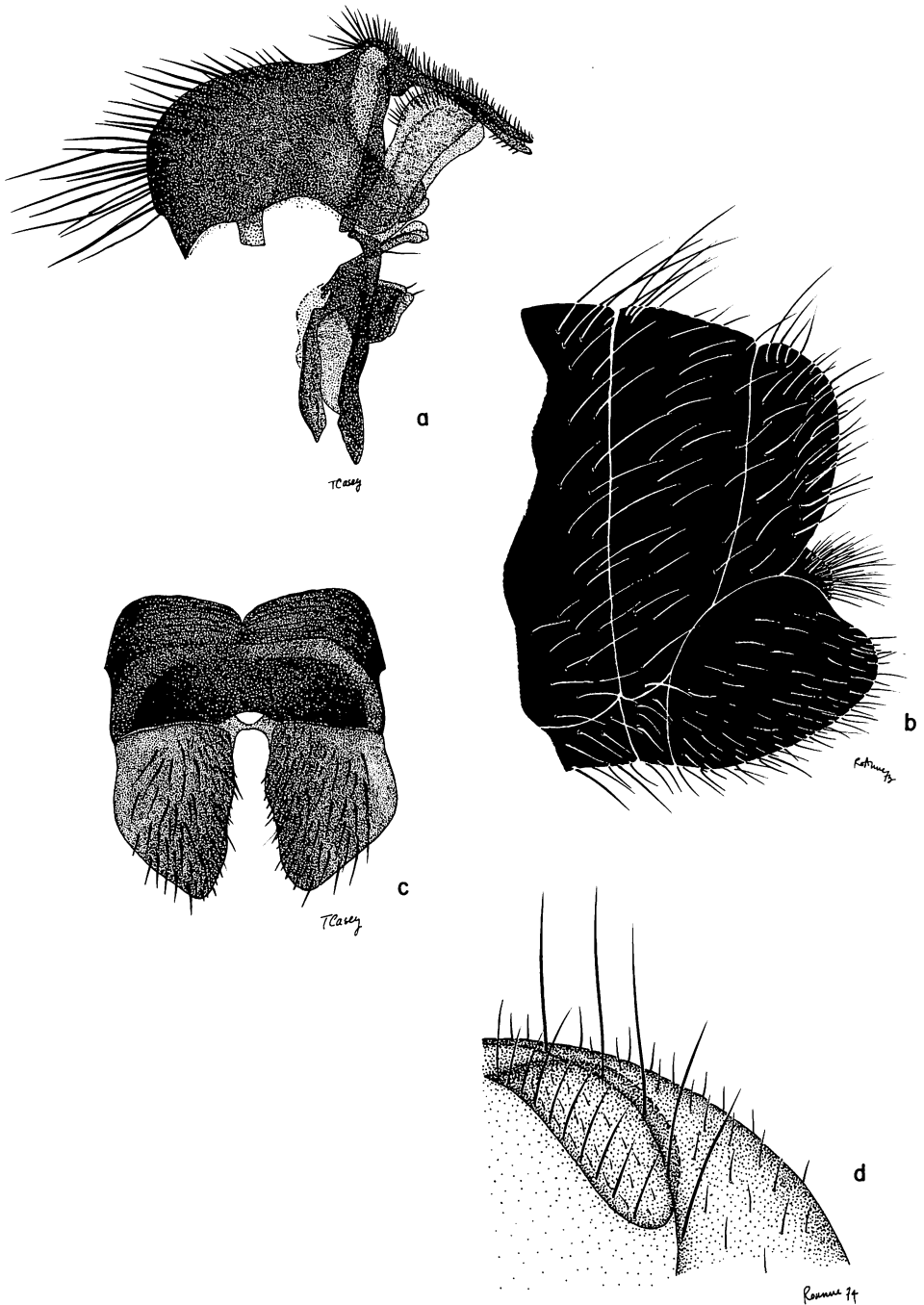


Figure 148—*Dyscritomyia retracta* James, n. sp.: a, male genitalia, lateral; b, apex of male abdomen, lateral; c, fifth sternum of male, ventral; d, right one-half of female 5th and 6th terga, end view.

one-eighth length of tergum; white pollen more distinct at incisures and on sides of tergum 1. Vestiture of abdomen black; no development of unusual hairs. Tergum 1 with median marginals weak or absent; median marginals on 2, along with weak marginal row; marginal row well developed on 3 and 4; median dorsals on 2-4. Lobe of fifth sternum large, broad, trapezoidal, well projecting ventrad equal in size to epandrium and short setose (figs. 148b,c). Hypopygium shining black and as in figure 148a.

Length: 9.5-10.0 mm.; of holotype, 9.5 mm.

FEMALE. Vertex 0.25 head width, frons widening to 0.35 across lunule. Parafacial at antennal base 0.12, narrowing to 0.10, then broadening to gena. Frontale with a few very short, scattered, black seta-like hairs. Pregenital plates orange-brown, divided vertically but not distinctly separated (fig. 148d), rigid, well sunken below tergum 5, which projects well beyond them dorsally and laterally.

Length: 9.0-10.3 mm.

Holotype male: Mohihi Ridge, Kauai, July 1940 (E. H. Bryan, Jr.). Eleven paratypes, 4 males and 7 females, from following localities on Kauai: Kokee, Mokihana, July 25, 1940 (Bryan); Summit Camp, February 1927 (F. X. Williams); same but September 2, 1920 (O. H. Swezey); same data as holotype; Kalalau, August 8, 1925 (O. H. Swezey); Pihea, Kaunuohua Ridge, 4,260 ft., August 1, 1963 (D. E. Hardy); Mt. Kahili, September 2, 1970 (S. L. Montgomery) and Swamp Trail, Waineke Swamp, July 22, 1968 (D. M. Tsuda).

The holotype and some paratypes are in the B. P. Bishop Museum; additional paratypes are in the collections of the University of Hawaii, Washington State University, and the U. S. National Museum.

***Dyscritomyia robusta* (Grimshaw), new combination (figs. 149a-e)**

Prostethochaeta robusta Grimshaw, 1901, Fauna Hawaiiensis 3(1):24.

Endemic. Lanai (type-locality: Koele Mts., above 2,000 ft.), Maui, Molokai. Type male in the British Museum (Natural History). Very common in some areas in the mountains, especially on the slopes of Puu Kukui, West Maui, elev. 3,000-4,000 ft.

This is the type species of *Prostethochaeta* Grimshaw and is the largest known species of *Dyscritomyia*. The coloration varies from metallic green, coppery green, deep blue to purple. It resembles *terryi* Bryan and *bryani* n. sp.; but these are not related: the genitalia are very different; in both *bryani* and *terryi*, the frons of the male is much broader; in *robusta* and *bryani* the posthumeral bristle is present and the lobes of the fifth sternum are broad and conspicuously directed ventrad, whereas in *terryi* the posthumeral is lacking and the lobes of the fifth sternum are slender, strap-like, and not directed ventrad. The lobes of the fifth sternum are as in figures 149b,c and the genitalia are as in figure 149d. The surstyli (posterior lobes of epandrium) are slender, rather pointed apically, and the secondary lobes are long, slender, and strongly curved downward.

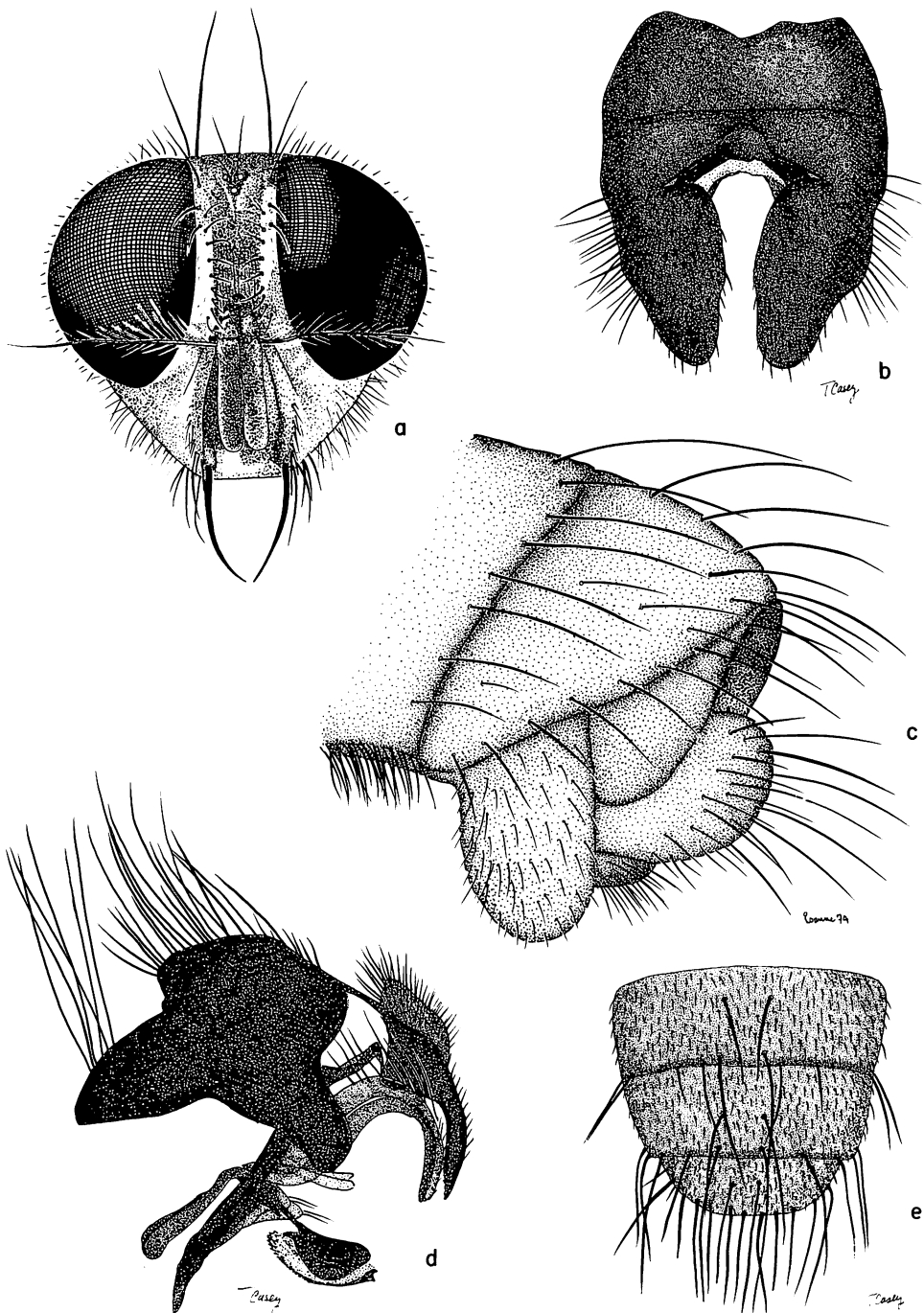


Figure 149—*Dyscritomyia robusta* (Grimshaw): a, head of female, frontal view; b, fifth sternum of male, ventral; c, apical portion of male abdomen, lateral; d, male genitalia, lateral; e, abdomen, dorsal view, showing bristle arrangement on terga 3-5.

The frons of the females are parallel-sided on upper half (fig. 149a). The bristle arrangement on the abdomen as in figure 149e.

Length: 9.5–12.0 mm.

***Dyscritomyia scopifera* James, new species (figs. 150a,b)**

Lacking the posthumeral bristle and fitting in the subgroup which has the costal margin infuscated. It is most closely related to *digitata* n. sp., from which it is best separated by the clouding of the anterior part of the wing. Perhaps the two may best be interpreted as subspecies of one polytypic species.

MALE. Frons, at narrowest, 0.15 head width, widening to 0.22 at vertex and 0.28 across lunule. Frontale, at narrowest, 0.08 head width; parafrontal, at antennal bases, 0.12, narrowing to 0.07 at gena. Head black, genal depression sometimes brown; parafrontals, except above, parafacials, and narrow occipital orbits densely silvery-pollinose, genae and upper parafrontals shining to subshining green, large part of occiput with a greenish sheen through the relatively sparse pollen; frontale velvety, with brown pollen. All head hairs and bristles black except some on occiput below neck. Outer verticals not developed but uppermost hairs of occipital orbital fringe longer than those below. Parafrontals 8–9, long, plus some long hairs in parafrontal row and some shorter ones outside it; uppermost parafrontals tending to be a little longer than others and reclinate. Antenna ending a short distance above vibrissae; flagellum 2.5 as long as pedicel and 3.0 as long as wide; arista brown, with 9 to 10 long rays above and 5 to 6 below. Palpus yellow, becoming brown to brownish black toward apex; proboscis black.

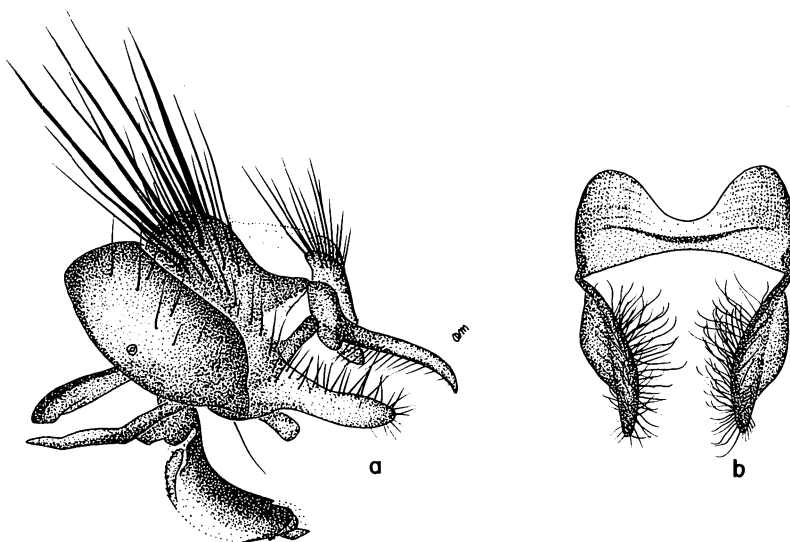


Figure 150—*Dyscritomyia scopifera* James, n. sp.: a, male genitalia, lateral; b, fifth sternum of male, ventral.

Thorax bright green to blue green; pollen not noticeable, except under oblique lighting, but having a somewhat dulling effect. Hairs of mesonotum moderately thick, erect. Propleuron with fine, whitish hairs; other hairs and bristles of thorax black. Acrostichals 2,1; dorsocentrals 2-3,3; humerals 3; posthumeral wanting; discoscutellar 1. Coverings of anterior and posterior spiracles brown.

Legs simple; coxae mostly green; femora blackish brown but all pairs, especially the fore and middle, becoming extensively metallic green, the fore pair largely so; tibiae and tarsi dark brown. Wing strongly clouded anterior to vein $R_2 + 3$ and bordering that vein in cell R_3 , behind that more lightly so and becoming subhyaline toward posterior margin; costal spine small. Squamae white; halter light brown.

Abdomen mostly bright metallic green but with coppery reflections, which may be intense on the posterior segments (as in the holotype); tergum 1, black medially on dorsal surface and basally elsewhere; terga 2 and 3, with broad posterior black margins, each one-fourth to one-third as wide as length of segment. Tergum 2 with long median marginals and a weak marginal row; 3 and 4 with strong marginal rows; 2-4, each with 1 median dorsal pair. Hairs of terga semi-appressed except at base; sterna 2-4 with a dense mat of long, crinkly hairs, forming a continuous scopa-like complex covering the three sterna. Lobes of sternum 5 elongated, digitate but tapering toward apex, set below with moderately short but prominent, erect hairs (fig. 150b). Genitalia as in fig. 150a.

Length: 5.5-7.0 mm.; of holotype, 7.0 mm.

FEMALE. Vertex, 0.25 head width, frons widening to 0.33 across lunule. Outer verticals well developed. 1 or 2 proclinate and 1 reclinate fronto-orbitals. Frontale black-pollinose; no setulae present. Tergum 5, undivided, arched above withdrawn genital segments.

Length: 6.5-9.0 mm.

Holotype male: Kawela, Molokai, 3,700 ft., December 22, 1925 (E. H. Bryan, Jr.). Eleven paratypes, 5 males and 6 females from following localities on Molokai: same data as type; same (O. H. Swezey); Kainalu, 2,000-3,000 ft., July 27-29, 1927 (E. H. Bryan); Waikolu, December 18, 1925 (E. H. Bryan); Kamiloloa, 3,200 ft. (E. H. Bryan).

The holotype and some paratypes are in the B. P. Bishop Museum; additional paratypes are in the collections of the U. S. National Museum, University of Hawaii, and Washington State University.

Dyscritomyia similis James, new species (figs. 151a-c)

Fitting the "Prosthetochaeta" species group in the subgroup characterized by having the male frons comparatively narrow. It is closely related to *obscura* (Grimshaw) and to *lucilioides* (Grimshaw) and is differentiated by the characters given in the key above.

MALE. Frons at narrowest 0.05 head width, widening to 0.15 at vertex, and

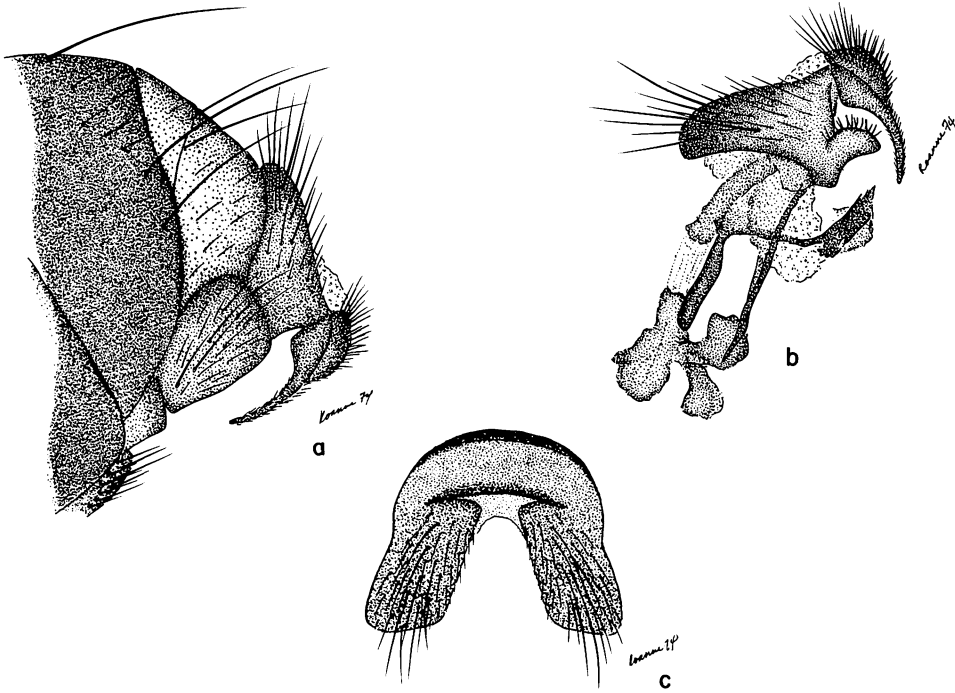


Figure 151—*Dyscritomyia similis* James, n. sp.: a, apical portion of male abdomen, lateral; b, male genitalia, lateral; c, fifth sternum of male, ventral.

0.22 across lunule; parafrontal 0.08 head width, almost parallel-sided; frontale at narrowest linear. Head black; genal depression with some reddish brown coloration; lower part of frontale reddish brown. Head mostly densely white-pollinose; pollen becoming brown on upper parafrontal, then thinning out adjacent to ocellar triangle, parafrontals there and also ocellar triangle with green reflections; pollen sparser on occiput except orbits, where the green reflection shines through; that of frontale concolorous with background. Outer verticals weak, but little distinguishable from postocular fringe of setae; parafrontals 11, small, increasing in length and strength toward antennal bases, the uppermost suddenly much longer and stronger, reclinate, forming in effect a well-defined reclinate fronto-orbital. Parafrontals with only a few short, scattered hairs; parafacials bare. Vestiture of head black except some yellow hairs on lower part of occiput.

Thorax shining bright green; white pollen clearly evident on propleuron and sternopleuron, otherwise visible only under oblique lighting. Acrostichals 2,2-3; dorsocentrals 2,3; humerals 3; posthumeral present; lateral basal scutellar 1; discoscutellar 1. Mesonotum with rather sparse but evenly distributed erect, short setulae, those of scutellum and pleura mostly thicker and longer. All vestiture black. Anterior and posterior spiracles black.

Coxae and femora green (middle legs except coxae missing); tibiae and tarsi brown; legs simple. Wings pale brown; veins yellow to brownish yellow; costal spine but poorly developed. Squamae white with pale yellow margins; halteres yellow.

Abdomen bright shining green with strong coppery reflections medially on terga; white pollen visible under strongly oblique lighting; vestiture black. Strong median dorsals on terga 2-4 (missing on one side of 4 in type); median marginals on 2-4; a strong lateral marginal on 1. Lobe of fifth sternum small, rather triangular as seen in lateral view (fig. 151a) and in ventral view as in figure 151c. Genitalia as in figure 151b.

Length: 6.7-7.3 mm.; of holotype 7.3 mm.

FEMALE. Frons about 0.25 head width at vertex, broadening to 0.33 at lunule. Faciae approximately parallel-sided, mostly black. Proclinate fronto-orbitals 2, reclinate fronto-orbital 1, outer verticals well developed. Abdominal pollen more conspicuous on ventral aspects of terga, adjacent to sterna. Sixth tergum entire, forming an arch over the genital segments.

Length: 7.0-7.5 mm.

Holotype male: S. Kona, Hawaii, August 6, 1919 (O. H. Swezey). Ten paratypes, 1 male and 9 females, from following localities on Hawaii: Honomalino, in cue-lure, February 8, 1968 (R. Cunningham); 1 female, Laupahoehoe Forest, December 9, 1971 (M. D. Delfinado); Honokane Nui Valley, 1,500 ft., August 11, 1970 (S. L. Montgomery); Hilo, July 1900 (W. H. Henshaw), in rather poor condition, appears to be this species but is not included in the paratype series. Specimens have been attracted to crushed snails and to brewers yeast bait.

The holotype is in the U.S. National Museum, type no. 72554. Paratypes are in the collections of the University of Hawaii and Washington State University.

***Dyscritomyia sternacantha* James, new species (figs. 152a-d)**

Very near *pectinata* n. sp. and differing by the characters of the fourth and fifth sterna of the male and by the male genitalia as discussed under *pectinata* and as shown in figures 147 and 152.

MALE. Frons at narrowest 0.22 head width, widening to 0.30 at vertex and 0.35 across lunule. Frontale almost parallel-sided but narrowing somewhat below, twice width of parafrontal at its narrowest; parafacials narrowing from antenna to gena, with about four evident but not prominent transverse rugulae. Middle of face shallow, merging into epistoma. Head black with whitish pollen; that of occipital orbits and facialia dense, silvery; vertex, genae, and lower part of occiput subshining. Lunule small, glossy. Parafrontal with a few short, scattered, erect hairs; parafacials bare. Vestiture of head almost wholly black; a small divided tuft of silky whitish hairs above neck and a few whitish hairs mixed with the black hairs of the lower occiput; pile of occiput stiff. Outer verticals small, proclinate; about 10 parafrontals, approx-

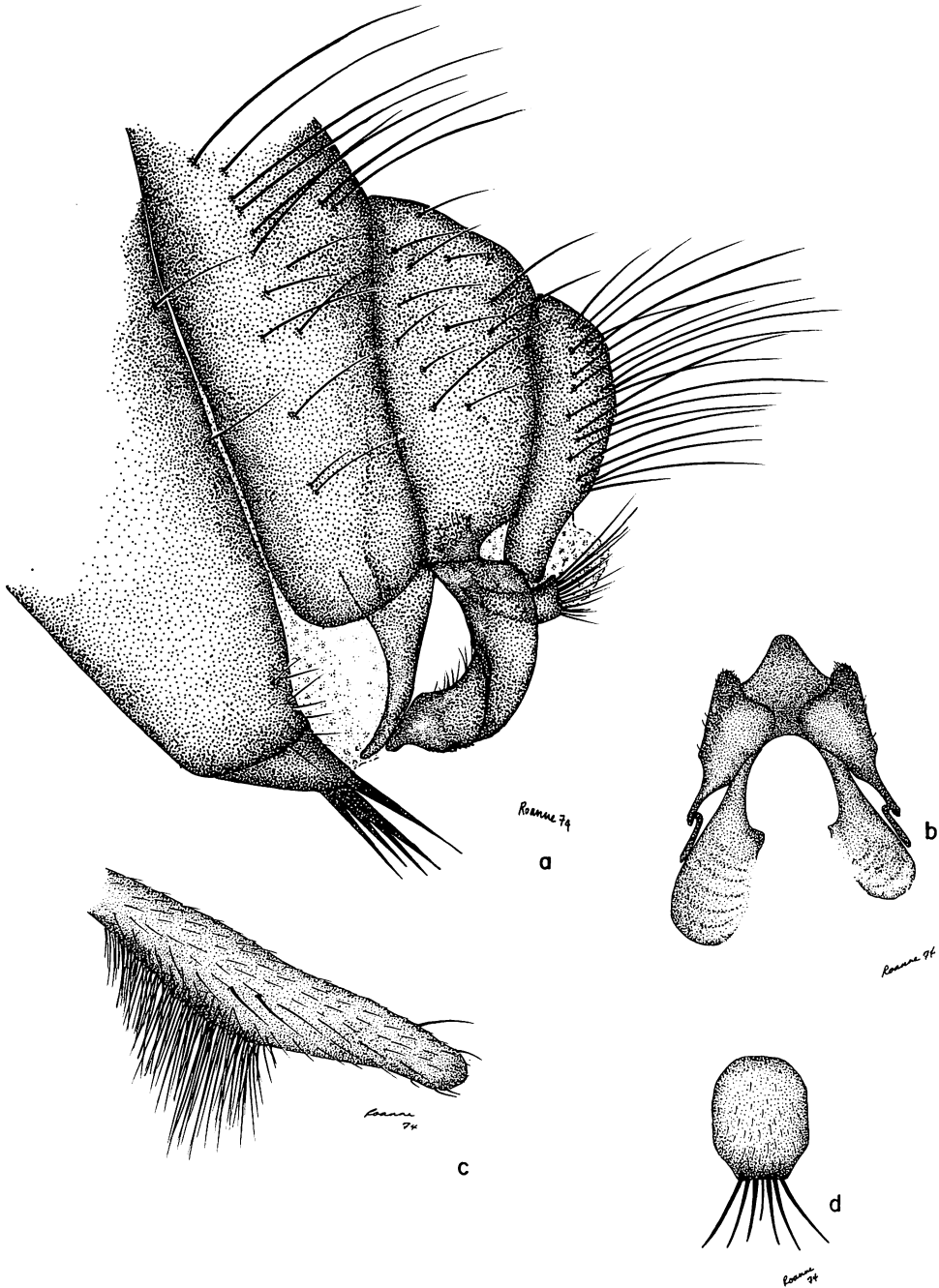


Figure 152—*Dyscritomyia sternacantha* James, n. sp.: a, apical portion of male abdomen, lateral; b, fifth sternum, ventral; c, mid femur of male; d, fourth sternum of male, ventral.

imately equal in length and strength to each other and to ocellars, uppermost, however, a little longer and reclinate. Antenna black; flagellum reaching almost to vibrissae, about 3.5 as long as pedicel and about 4.0 as long as wide. Arista black, becoming brown or yellowish brown on apical half; about 15 moderately long rays above and about 10 shorter ones below, rays limited to basal two-thirds of arista. Palpus brownish-black, proboscis black.

Thorax blackish green, becoming bluish green laterally, and blackish to brownish black under wing bases; upper pleura almost devoid of pale pollen and strongly shining, otherwise with pale pollen which is evident under oblique lighting, that of lower sternopleura conspicuous. Mesonotum, scutellum, mesopleuron, and upper parts of sternopleuron with rather abundant, moderately long, evenly spaced, black setulae; these are longer on the pleura and scutellum than on the mesonotum. Propleuron with fine, black hairs. Acrostichals 1-2,1; dorsocentrals 2,3; humerals 2; posthumeral lacking; discoscutellars missing.

Legs black. Femora thickened, particularly middle femur on basal three-fifths (fig. 152c). Middle femur with 2-3 median anterodorsals; anteroventral row reduced to 2 or 3 long bristles at end of the more greatly swollen area, plus 1 preapical; the posteroventral row is reduced to a few short bristles toward apex of femur plus a group of 7 or 8 closely appressed ones forming a spine-like pencil or fascicle, which is about two-thirds as long as the femur; between this fascicle and the anteroventrals, a remarkable brush consisting, dorsad, of about two rows of long bristle-like setae, which become shorter toward base of femur; the composite of unusual hairs and bristles forming a unified complex. Hind femur with anterodorsal and anterior rows close together and with some crinkly hairs basally; a long anteroventral near apex and a group of about 6 long bristles close together medially on anteroventral and ventral surfaces.

Wing deep brown along costal margin, a little more lightly so toward apex of cell R_1 , and bordering $R_2 + 3$ for about two-thirds length of cell R_3 , also more extensive at wing base; membrane otherwise diffused brownish, almost hyaline. Costal spine as long as width of cell 2nd C. Squamae and cilia almost white. Halteres brown to brownish black.

Abdomen deep, conical, almost as deep as wide at base, deeper than wide on segments 3 and 4; metallic dark blue-green to greenish black, somewhat dulled by pollen visible under oblique lighting, effects of pollen less evident laterally. Tergum 1 with lateral group of 1-3 bristles; 2 with median dorsal and median marginal pairs plus 1 lateral; 3 with 1-2 median dorsals and short marginal row in addition to outstanding median marginals; 4 with irregular dorsal and marginal rows. Abdomen with regularly distributed, short, black setulae, longer laterally, over most of surface. Tergum 4 incised V-like medially above; sterna 2 and 3 concealed; 4 projecting prominently ventrad, beset apically with a group of 6 stout bristles directed ventrad (fig. 152d); sternum 5 with a knob-like median portion which projects ventrad behind apex of 4 (fig. 152b); lobe of fifth sternum digitate, glabrous basally, somewhat thickened apically, clothed there with only ordinary short hairs. First tergum of hypopygium well sclerotized except medially, where it is semi-membranous,

especially at apex. Hypopygium beset with numerous bristles and bristle-like setae apically. Genitalia as in figure 152a.

Length: 9.0–10.0 mm.

FEMALE. Unknown.

Holotype male: Kilauea, Hawaii, July 28, 1935 (E. H. Bryan, Jr.).

Paratypes: 2 males, Kilauea, February 17, 1916 (O. H. Swezey).

The holotype is in the B. P. Bishop Museum; one paratype is in the collection of Washington State University and one paratype in University of Hawaii collection.

***Dyscritomyia terryi* Bryan (figs. 153a–c)**

Dyscritomyia terryi Bryan, 1934, Proc. Haw. Ent. Soc. 8(3):419.

Endemic. Oahu (type-locality: Mt. Olympus). Type male in the B. P. Bishop Museum. Common at higher elevations on Oahu, both in the Koolau and Waianae ranges.

This species is similar in appearance to *robusta*, and the most obvious differences are discussed under that species. Though a large, shining green species, its size averages somewhat smaller than *robusta*. Males may easily be separated on the basis of the genitalia and the much broader frons of *terryi*. One female from Poamoho Trail, Oahu, has the posthumeral abnormally developed and consequently may be confused with *robusta*. However, *terryi* is known only from Oahu and *robusta* occurs on Maui, Molokai, and Lanai. The lobes of the fifth sternum of the male are long and slender (figs. 153a,c) and the male genitalia as in figure 153b.

Length: body, 7.5–10.0 mm.

***Dyscritomyia viridis* Hardy, new species (figs. 153d–e)**

By lacking posthumeral bristles, having the wings uniformly hyaline and the abdomen bright green, this would run out with *affinis* Grimshaw, from Oahu. It is differentiated by having the eyes of the male close together on the front, at narrowest point separated by scarcely more than the width of the median ocellus, rather than the front being comparatively wide, about three times wider than ocellar triangle; squamae dusky, tinged with brown and upper lobe brownish on front margin, rather than all white and abdomen entirely metallic green or coppery green, not with darker coloring along hind margins of terga. Also the fifth sternum of male and genitalia differ as shown in figures 139a–c and 153d–e.

MALE. *Head*: Frons narrow, as pointed out above. Face and occiput densely gray pollinose; genae rather thinly so, submetallic in direct light. Epistomal margin dark brown, slightly protruded so that from lateral view the head is slightly pointed directly in front of the strong bristle at top of vibrissal row. Antennae dark brown to almost jet black, third segment extending almost to epistoma. *Thorax*: Metallic green with a light gray pollinosity over the sternopleura as seen in indirect light. Anterior portion of mesonotum with a slight purplish sheen in ground color when viewed from in front in direct light. A

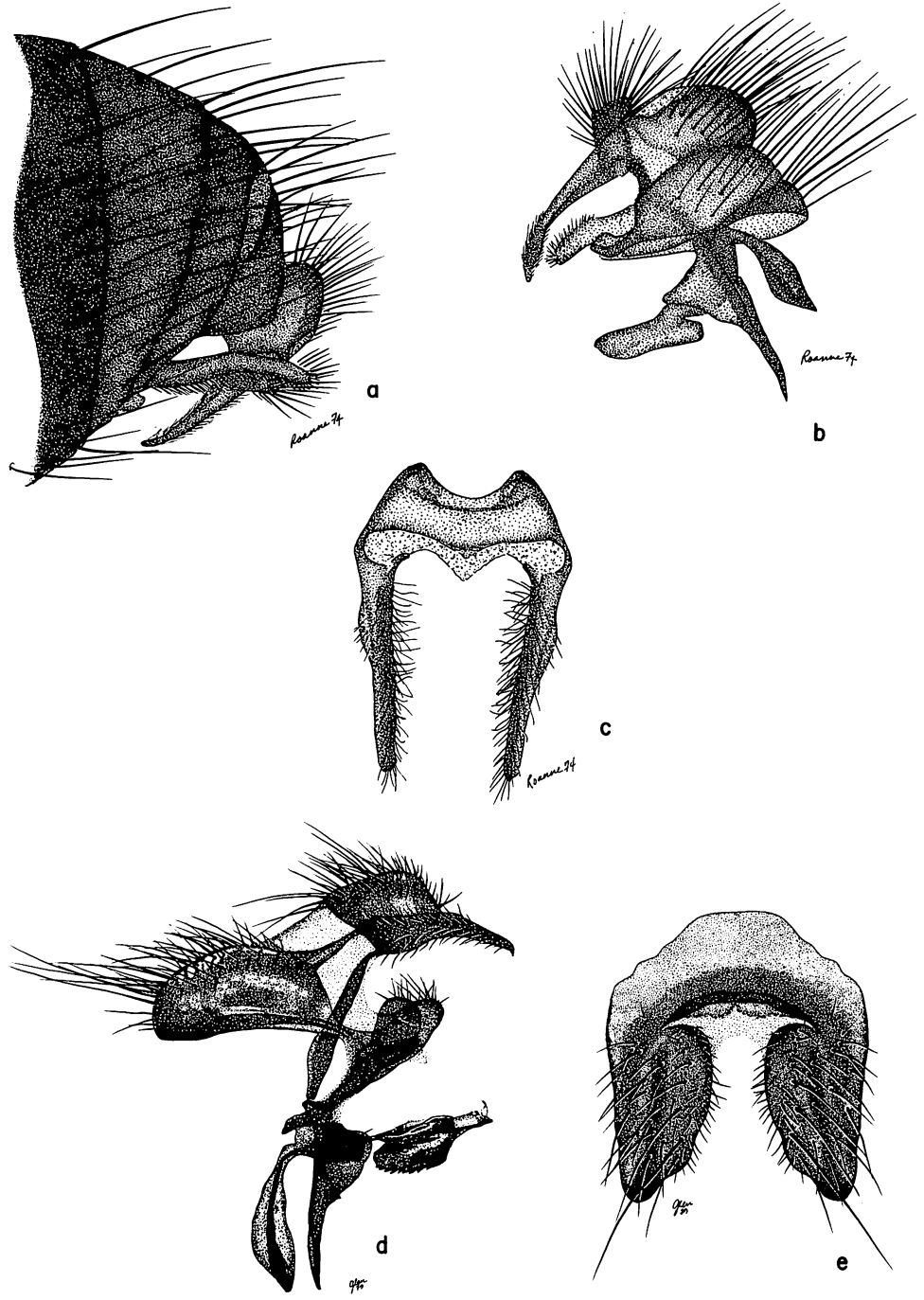


Figure 153—*Dyscritomyia terryi* Bryan: a, apical portion of male abdomen, lateral; b, male genitalia, lateral; c, fifth sternum of male, ventral. *D. viridis* Hardy, n. sp.: d, male genitalia, lateral; e, fifth sternum, ventral.

small posthumeral bristle is present on the left side in one male specimen (intergrading with the "Prostethochaeta" grouping). Two pairs of presutural acrostichals present, the anterior pair fine, almost hair-like. *Legs*: Black, with a metallic green sheen on femora. Bristling as in other *Dyscritomyia*. *Wings*: Entirely hyaline, lacking any darkened areas. Costal spine small, inconspicuous. Basicosta jet black. Squamae faintly tinged with brown, the upper lobe brownish on front margin. *Abdomen*: Entirely metallic green. Discal bristles present on terga 3-5. Lobes of fifth rather broad, with inner margins nearly straight-sided (fig. 153e) but inconspicuous *in situ*, not protruded ventrally. The genitalia are as in figure 153d.

Length: body, 6.7 mm.

FEMALE. Fitting description of male except for sexual characters. The frons is broad, 3.5 times wider than ocellar triangle. The interfrontal area is dull black with a tinge of rufous above lunule and lightly dusted with gray. The parafrontalia and parafacialia are densely silvery gray. Discal bristles lacking on third tergum. Sixth tergum entire, its posterior margin straight.

Length: body, 7.0 mm.

Holotype male, allotype female and seven paratypes, two males, five females: Halepiula Road, Kapua (land sect.), S. Kona, Hawaii, 4,650 ft., July 1977. Collected on fresh pig dung (D. E. Hardy). Also twelve paratype females from the following localities on Hawaii: logging road, Laupahoehoe Sec., 3,300 ft., January 6, 1970 (D. E. Hardy); near Pawaina, Kona, 3,000 ft., July 13, 1965 (D. E. Hardy); Lalakea Str., Kohala, January 7, 1970 (S. L. Montgomery); Alaa Park, September 29, 1971 (M. D. Delfinado); North Kohala, February 22, 1969 (G. K. Kobayashi); and forest north of Puu Lala, 2,600 ft., January 7, 1970 (S. L. Montgomery).

Type allotype and some paratypes in B. P. Bishop Museum. Other paratypes in collections of U.S. National Museum, British Museum (Natural History) and the University of Hawaii.

Genus **LUCILIA** Robineau-Desvoidy

Lucilia Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2)2:452. Type-species, *Musca caesar* Linnaeus, by subsequent designation (Macquart 1834:162).

Close to *Phaenicia* Robineau-Desvoidy but differentiated by having the subcostal sclerite hairy. The convexity above the metathoracic spiracle is bare, except for fine pubescence and that the suprasquamal ridge is setose (fig. 154a).

Only one species known, on the northwest Hawaiian Islands.

Lucilia graphita Shannon (figs. 154a-d)

Lucilia graphita Shannon, 1926, Bull. B. P. Bishop Mus. 31:72.

Endemic. Occurs only on the northwest Hawaiian Islands. Type-locality: Laysan Island. Also recorded on Ocean, Kure, and Midway Islands and on Pearl and Hermes Reef.

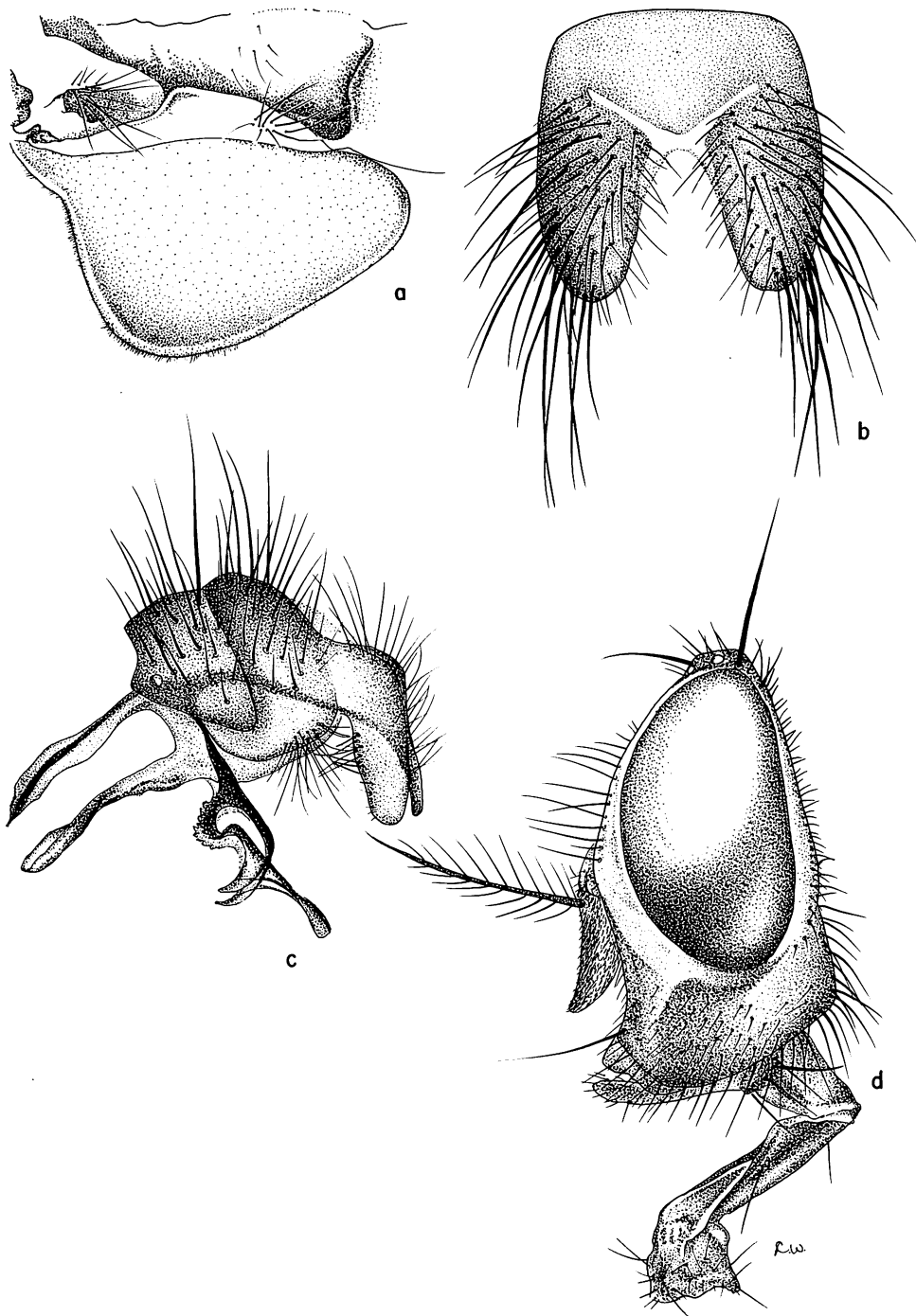


Figure 154—*Lucilia graphita* Shannon: a, calypter and suprasquamal ridge; b, fifth sternum of male; c, male genitalia, lateral; d, head, lateral.

Bionomics. A carrion breeder. The type and allotype were reared from a seal skull (Shannon 1926). Timberlake (1924:421) reared the pteromalid wasp, *Mormoniella brevicornis* Ashmead, from the puparia.

According to James (1962:115), it is similar in appearance to *L. snyderi* James, from the Bonin Islands, but differs by having three postsutural acrostichals not two (Shannon was in error in saying *graphita* had two); parafacialia rather broad, about equal in width to third antennal segment, and sides rather strongly diverging anteriorly, rather than parafacialia much narrower, almost straight-sided; posterior median, marginal bristles of third tergum recumbent, not with posterior median bristles of third erect; lower calypter brown, not nearly black; and basicostal scale yellow-brown, not black.

Because of the shining black body this more closely resembles *Phormia regina* than any other Hawaiian species. These, however, belong in different subfamilies and are not at all related.

Head slightly broader than high, as seen in direct frontal view. As seen from lateral view, distinctly higher than long with the epistomal margin slightly protruding (fig. 154d) and with the gena about one-fourth as high as eye in male and about one-third in female. Eyes of male rather closely joined, at narrowest point the frons is scarcely over half the width of the ocellar triangle and equal to about four rows of eye facets. Eyes of female widely separated, frons approximately one-third head width. Gena (bucca) mostly covered with gray pollen, anterior portion broadly rufous to orange, entirely covered with black hairs. Thorax and abdomen shining black with a faint pollinosity giving a graphite-like appearance, the pollinosity is indistinct. Two pairs each of presutural dorsocentrals and acrostichals and three pairs each of postsutural dorsocentrals and acrostichals. Metasternum bare except for a few scattered inconspicuous pale setae. Suprasquamal ridge as in figure 154a. Legs of fully hardened specimens almost entirely black, tinged rufous at apices of femora and bases of tibiae and with a distinct tinge of rufous in ground color of tibiae and ventral margins of femora. Many of the specimens on hand are apparently teneral and have varying degrees of rufous coloration on the legs. Wings entirely hyaline. Fifth sternum of male with the lobes well developed, broadly rounding apically (fig. 154b). Male genitalia as in figure 154c, with the surstyli broad, rounded, densely setose.

Length of body: 5.0–8.0 mm.; average, 6.5–7.0 mm.

Genus **PHAENICIA** Robineau-Desvoidy

Phaenicia Robineau-Desvoidy, 1863, Hist. nat. des Dipt. des environs de Paris 2:750. Type-species, *concinna* Robineau-Desvoidy, by subsequent designation (Townsend 1916:8), = *sericata* (Meigen).

Differentiated from *Lucilia* by lacking hairs along the suprasquamal ridge; having the eyes of the male rather widely separated, at narrowest point the frons nearly two times wider than ocellar triangle; and basicostal sclerite and base of costa yellowish.

Bionomics. Scavengers on wide assortment of decaying organic matter, at-

tracted into houses by food and garbage. Frequently cause myiasis of wounds and lesions on animals, including man; well known as sheep maggots over much of the world.

Some of the reported myiasis cases in Hawaii are discussed under the genus since the two species present have commonly been confused in the literature and in some cases only identified just to genus. It is probable that these flies may have been in large part responsible for the serious problems encountered in the period from about 1850 into the 1920s when sheep raising was an important industry on several of the Hawaiian islands. Refer to the discussion under *Chrysomya rufifacies* and *megacephala* and reports of Van Dine and Norgaard (1908) and Van Dine (1909). Very extensive losses to sheep from parasitism were attributed to *Chrysomya dux* (Esch.) = *megacephala*, but I feel this fly was involved only as a secondary invader feeding on gangrenous tissue. Van Dine and Norgaard (1908:56) said *Phaenicia sericata* was "suspected as being responsible for injury to sheep until the real culprit was found to be *Calliphora dux*."

Larvae, determined as *Phaenicia*, were recovered from the infected ear of an old man in Honolulu, January 1970 (Hardy 1971), and from a dehorning sore on a steer from Maui, October 1965. Other scattered cases of wound myiasis in cattle and other animals in earlier literature may have involved *Phaenicia* spp.

A second instar larva which appeared to be a *Phaenicia* sp. was coughed up by a woman at Kaneohe, Oahu, June 1960 (Hardy 1961). It is probable that this had been ingested with food and no evidence was found of enteric myiasis.

***Phaenicia cuprina* (Wiedemann) (figs. 155a-c)**

Musca cuprina Wiedemann, 1830, Aussereurop. Zweifl. Ins. 2:654.

For synonymy refer to James (1962:117) and to Kano and Shinonaga (1968:92).

Common on all the islands, especially at lower elevations. Not actually reported in Hawaii until 1947 (James 1948:85), see Joyce (1954). This was obviously confused with *sericata* in the earlier literature. The oldest record I have seen in collections is Oahu, January 1914.

Immigrant. Originally described from China. James (1968:118) says "probably of African origin; widely distributed throughout both hemispheres in the tropics, subtropics and warmer temperate regions."

Bionomics. This is the notorious sheep maggot of Australia and New Zealand and is also the principle cause of sheep strike in South Africa (Mackerras and Fuller 1937; Whitten 1942; Hepburn 1943; Moule 1951; and Norris 1959). The pathogenesis of *P. cuprina* has been discussed in detail by Fiedler (1951). Refer also to Zumpt (1965:52).

Zumpt (1965:53) cites a number of cases of traumatic myiasis in man, and, in animals other than sheep, occurring in Africa, India, and Australia.

Metallic green flies, usually with a distinct coppery sheen. Closely resembling *sericata* and frequently confused with this species. *P. cuprina* is separated by having the metasternum bare; male with a pair of strong secondary

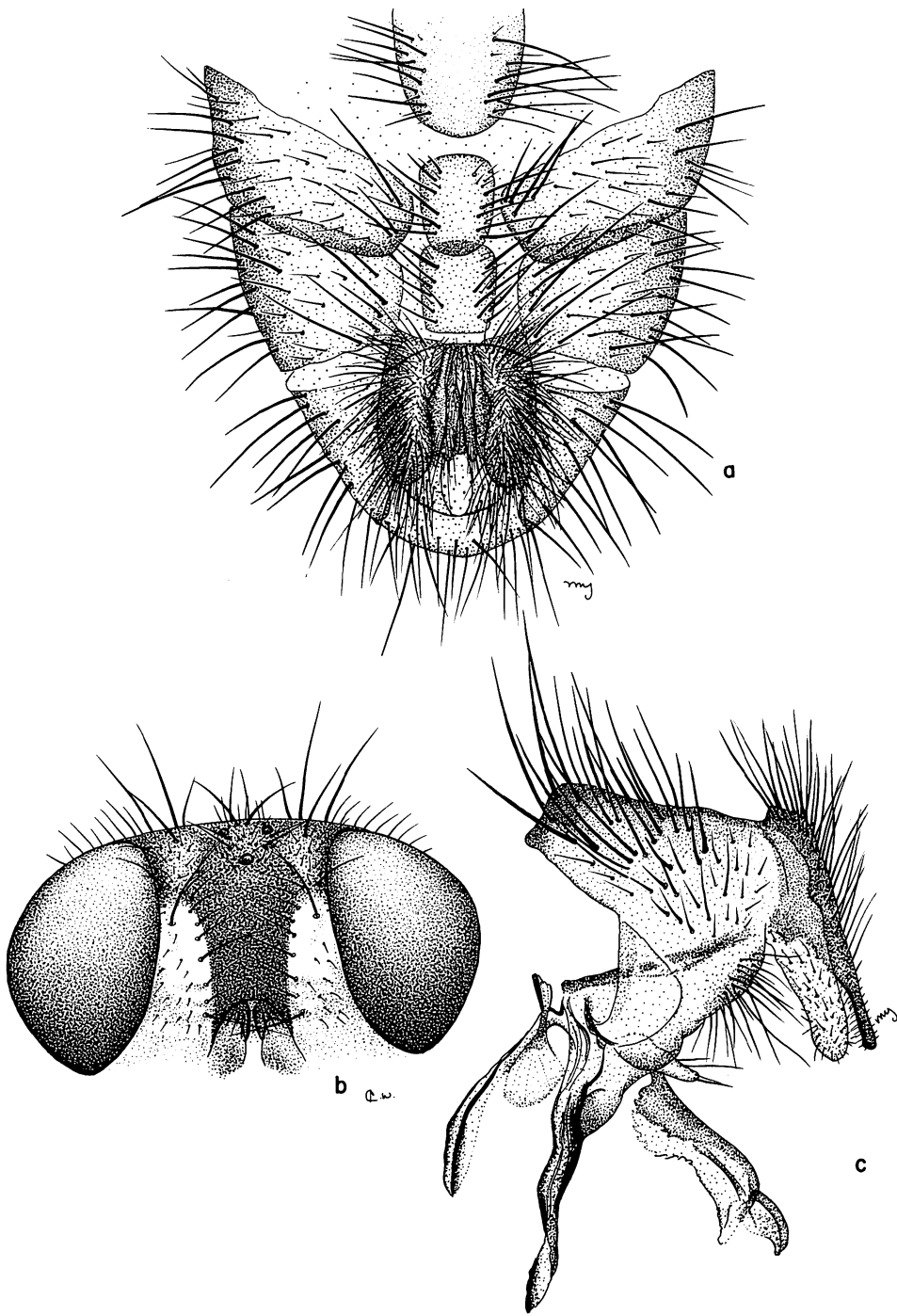


Figure 155—*Phaenicia cuprina* (Wiedemann): a, male abdomen, ventral; b, front of male head; c, male genitalia, lateral.

ocellars, immediately above the posterior ocelli (fig. 155b); frons of male rather broad, compared to *sericata*, about equal in width to 20 rows of eye facets or nearly one-fifth head width; male abdominal sterna and sides of terga long-haired (fig. 155a); lobes of cerci slender, parallel-sided on apical halves (fig. 155a); genae of female less than one-third eye height. The male genitalia are as in figure 155c.

Length: body, 5.5–8.0 mm.

This species is obviously very close to *pallescent* (Shannon) from the southern U. S. For the differentiating characters refer to Hall (1948:247).

***Phaenicia sericata* (Meigen) (figs. 156a–c)**

Musca sericata Meigen, 1826, Syst. Beschreib. bekannt. europaisch. zweifl. Ins. 5:53.

For synonymy refer to Hall, in Stone et al. (1965:928) and to Kano and Shinonaga (1968:95).

Widespread over all the islands, especially in the lowlands.

Immigrant. Cosmopolitan. Especially common in more temperate areas.

Bionomics. The common greenbottle fly of North America and Europe. It is an important contaminator of foods, is commonly involved in sheep strike over a large portion of the world, and has been frequently incriminated as causing traumatic myiasis in man and other animals. Refer to Zumpt (1965:49–50) and James (1948:87). The latter author says, "It has been known to attack man in Europe, Africa, and Asia, and may produce a serious form of wound myiasis. The young larvae feed near the surface but older larvae may bore deeply into healthy tissue. . . . The virulence of different strains varies. A Chinese strain is said to be particularly serious, whereas in America this species seems to confine its attacks to diseased tissue; in fact, it is the species most commonly used in wound therapy." A case of massive infestation of the navel of a baby boy in Virginia was reported by Pratt (1956).

In Hawaii a case of auricular myiasis in a five month old boy at Honokaa, Hawaii was recorded by Bess (1957). Specimens have been reared from soiled wool of sheep on Hawaii and have been reported causing wound myiasis in hind quarters of a sheep at Schofield Barracks, Oahu (B. S. Sugerman, pers. comm.).

Metallic green to blue, often with a coppery sheen and frequently confused with *cuprina*. Differentiated by having the metasternum setose; male lacking secondary ocellar bristles, or if rarely a pair is present behind ocelli they are scarcely larger than the postocellar hairs; frons comparatively narrow, equal in width to 17 eye facets and about one-eighth head width; under portion of male abdomen with ordinary hairs; fourth sternum with evenly scattered setae over entire sclerite (fig. 156a); lobes of cerci gradually tapered to apices; genae of female broad, nearly two-fifths eye height. Male genitalia as in figure 156c. Calypters and suprasquamal ridge as in figure 156b.

Length: body, 5.0–10.0 mm.

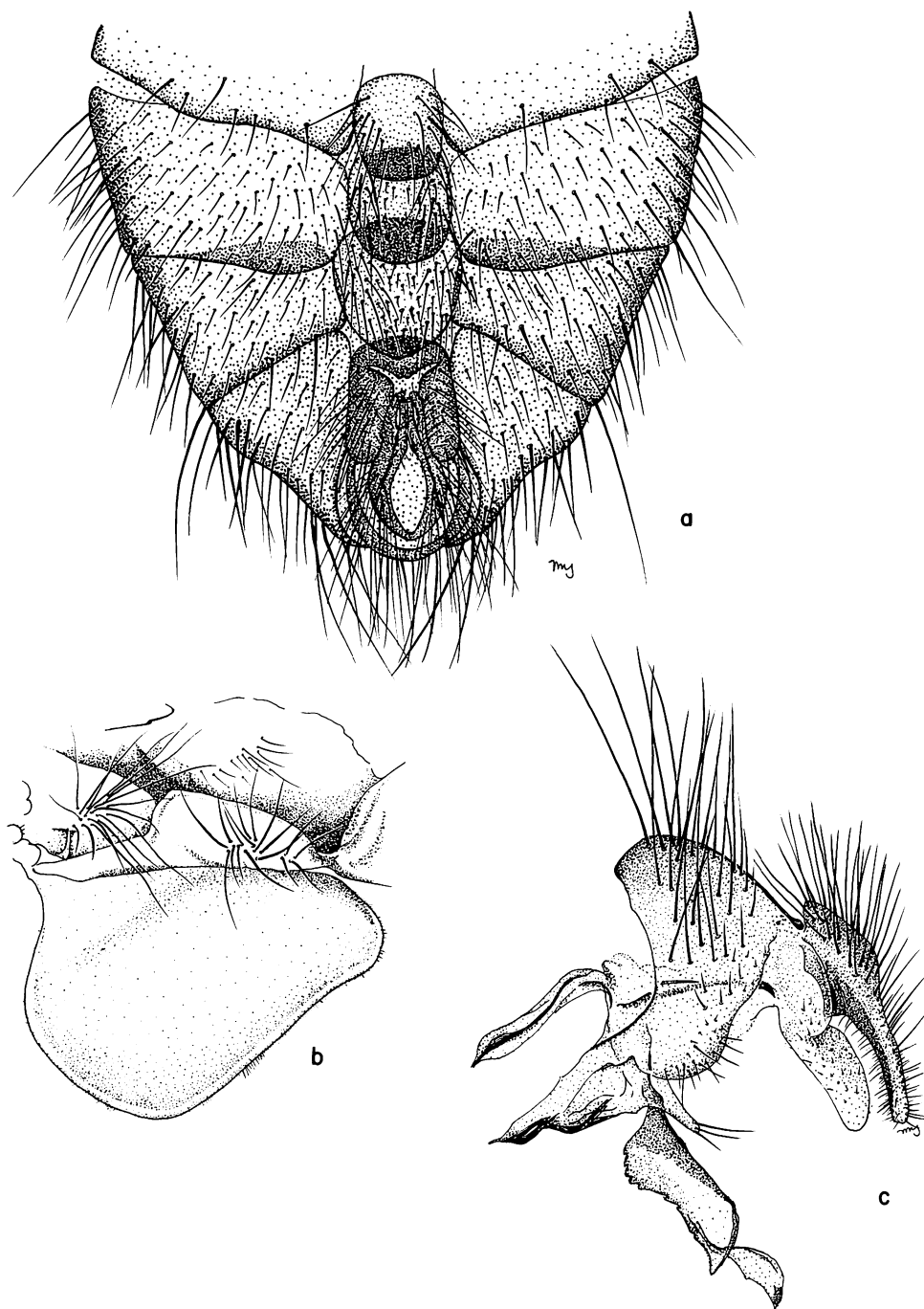


Figure 156—*Phaenicia sericata* (Meigen): a, male abdomen, ventral; b, calypter and suprasquamal ridge; c, male genitalia, lateral.

Subfamily CHRYSOMYINAE

Differentiated from other calliphorids, which have the basal portion of radius ciliated posteriorly above by having the occiput flat, orbits comparatively broad and covered with fine hair. The base of radius is ciliated above (fig. 157d).

Two tribes are present in Hawaii.

Tribe CHRYSOMYINI

Characterized by having the lower calypter subtruncate at apex, densely pilose above (fig. 157a), and the prealar callus with dense, erect hairs. Also, body metallic blue or green and the head largely yellow to orange, except for the compound eyes.

Only one genus present in Hawaii.

Genus **CHRYSOMYA** Robineau-Desvoidy

Chrysomya Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2)2:444. Type-species, *regalis* Robineau-Desvoidy, = *Musca marginalis* Wiedemann (1830) by subsequent designation (Rondani 1863:27).

For synonymy refer to Kano and Shinonaga (1968:102). As pointed out by James (1948:66), the generic name should be spelled *Chrysomya*, not "*Chrysomyia*."

Rather large, metallic blue or coppery green flies easily differentiated from other Hawaiian calliphorids by having base of radius setose and upper calypters densely pilose. The postalar declivity (the nearly vertical area immediately behind and below the postalar bristles and above the suprasquamal ridge) is densely haired (fig. 157a), and the suprasquamal ridge has at least some fine hairs along most of its length.

Parasites. The pupae of *Chrysomya* were found heavily parasitized by an encertid wasp, *Tachinaephagus zealandicus*, on Oahu (Funasaki 1970). This wasp was purposely introduced into Hawaii in 1967, from California, for biological control of the housefly.

Two species occur in Hawaii.

Chrysomya megacephala (Fabricius) (figs. 157a-d)

Musca megacephala Fabricius, 1794, Ent. Syst. emend. et aucta 4:317.

Musca dux Eschscholtz, 1822, Entomographien. Naturw. Abhandl. aus Dorpat 1:114.

For other synonymy refer to Kano and Shinonaga (1968:106).

Common throughout the islands, up to about 4,000 ft. elevation. This species probably reached Hawaii from the Orient during the early period of cattle, sheep, and goat introductions. It was first reported by Grimshaw (1901:27) as

Calliphora azurea (Fallén), collected at Kona, Hawaii, 1892. In the early literature it was called the "Hawaiian sheep maggot fly," and was reported under the combinations *Lucilia* and *Pycnosoma* and as *Chrysomyia dux* (Esch.).

Widespread over Oriental, Australian, and Pacific regions; also Japan, Ryukyu Islands, China, Egypt, and the southern Palaearctic Region.

Bionomics. Breeds in all kinds of animal matter and is the dominant carrion breeder throughout the islands up to about 4,000 ft. elevation.

In early literature this species was frequently incriminated in cases of wound myiasis in man and other animals in other parts of the world but these probably, almost without exception, were based upon misidentifications of *C. dux* (Esch.), and it is probable that *megacephala* larvae feed entirely, or almost entirely, as scavengers. However, scavenger flies are notoriously adaptable and under some circumstances may change their feeding habits. Strickland and Roy (1940) experimentally produced a fatal enteric myiasis in a puppy using *megacephala* and "it is conceivable that it may occasionally be involved in human enteric myiasis" (James 1948:75). Zumpt (1965:97) indicated that *megacephala* "larvae are occasionally found as facultative parasites in traumatic myiasis," and James (1962:123) says that "it occasionally will infest foodstuffs or invade diseased tissue of living animals, including man."

During the period of the early investigations of livestock pests in Hawaii, this species was referred to as the "Hawaiian sheep maggot fly" and, according to reports by Norgaard (1907), Van Dine and Norgaard (1908), and Van Dine (1909), was an extremely serious pest of sheep in the islands. The fly actually causing the parasitism, which they reported to be very common, was very probably *rufifacies*, rather than *megacephala*. The former was not recognized in Hawaii until 1918 (Illingworth 1918). (See discussion under that species.) The specimens which have come to my attention, reared ex sheep, were *C. rufifacies* and *Phaenicia sericata* and *cuprina*.

This is one of the most common flies associated with man in India and some other parts of Asia where it is commonly referred to as the "latrine fly." The adults are strongly attracted to human excreta and to exposed foods in the open markets, especially to fish, meats, and anything sweet. They are important harbingers of intestinal pathogens of man and other animals.

Timberlake (1924:421) reported it being attacked by the pupal parasite *Mormoniella brevicornis* Ashmead (Pteromalidae).

C. megacephala resembles *bezziana* Villeneuve and has, in earlier literature, been confused with that myiasis-causing species. It is differentiated by having the calypters waxy white, rather than yellowish to dirty gray; facets in lower third of male eye greatly reduced in size compared to upper facets, rather than facets all of uniform size, and sides of female frons lightly convex, not straight. It differs strikingly from *rufifacies* by its consistently larger size; body blue to blue-green and face and bucca yellow to orange. The ground color not obscured by pollen, and the latter yellow-golden pilose. Eyes of male almost touching on the front, upper facets enlarged and sharply demarcated from the small ones on lower third (refer to James 1948:68, fig. 31). Male lacking outer

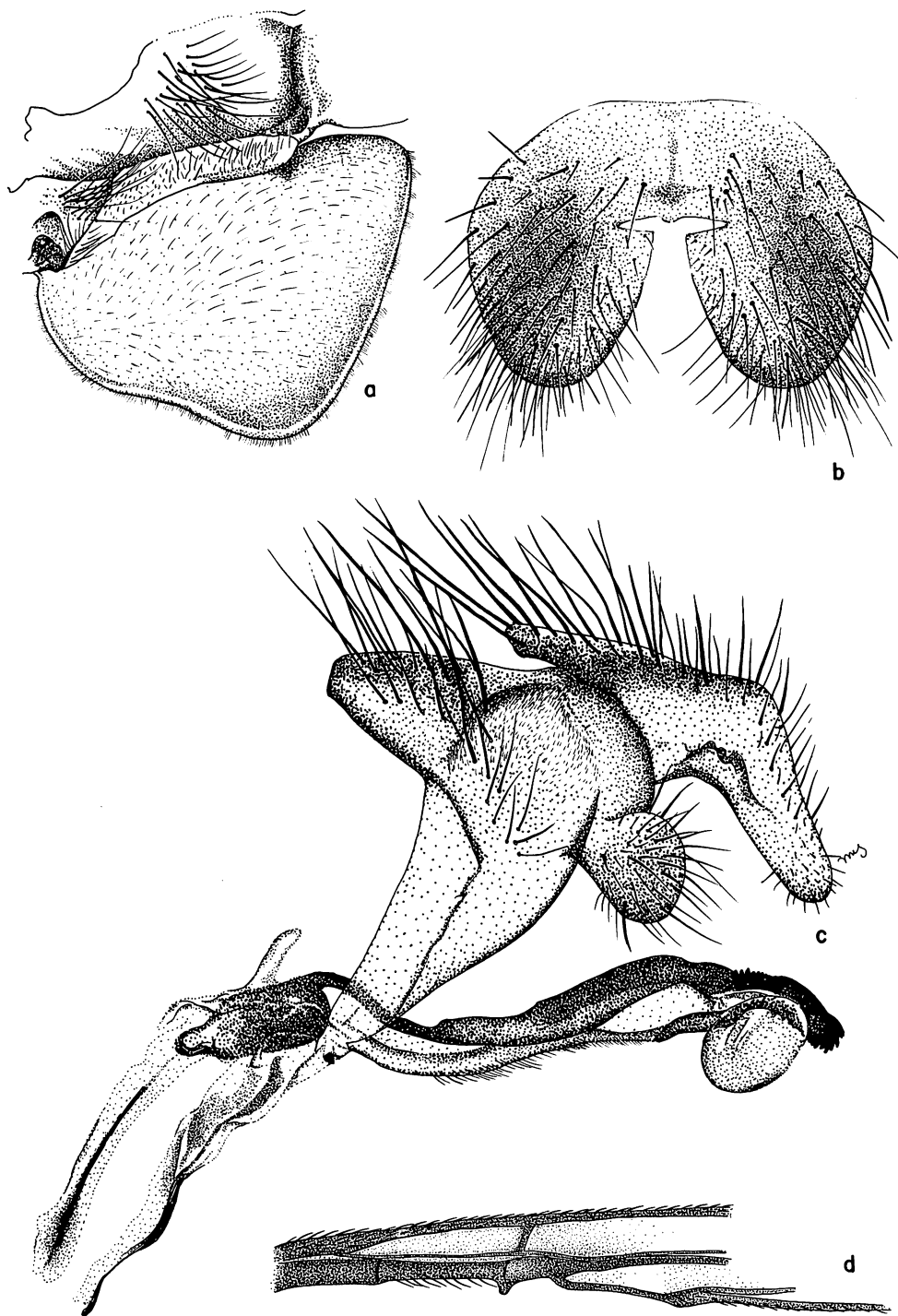


Figure 157—*Chrysomya megacephala* (Fabricius): a, calypter, postalar declivity and suprasquamal ridge; b, fifth sternum of male, ventral; c, male genitalia, lateral; d, anterior portion of wing showing base of radial vein.

vertical bristles. Female with two to three small black fronto-orbital bristles. Suprasquamal ridge with rather numerous brown hairs over most of its length (fig. 157a). Fifth sternum of male with a deep V-shaped concavity on hind margin, lobes well developed (fig. 157b). Cerci and surstyli comparatively short and blunt (fig. 157c). Female fifth tergum entire, not split apically.

Length of body: 8.0–10.0 mm.

For a more detailed description refer to Kano and Shinonaga (1968:106) and for discussion of male and female terminalia, to Thomas (1951:152–155).

***Chrysomya rufifacies* (Macquart) (figs. 158a–e)**

Lucilia rufifacies Macquart, 1843, Mém. Soc. Sci. Agric. Lille, p. 303.

For synonymy refer to Kano and Shinonaga (1968:103). It should be noted that Fan (1965:196) placed this in the subgenus “*Achaetandrus* Bezzi” (misspelling for *Achoetandrus* = synonym of *Chrysomya*).

Widespread over all the islands up to about 4,000 ft. elevation. First reported by Illingworth (1918) who called it “the common sheep maggot of Australia.” It was reported in some of the early Hawaiian literature as *C. albiceps* (Wiedemann).

Immigrant. Widely distributed over Oriental and Australian regions, Japan, and the Pacific area.

Bionomics. The first stage larva is necrophagous and the second and third stages are typically predaceous upon other fly larvae. It has been demonstrated, however, that they can be reared on rotting meat in the laboratory and the later instar larvae are obviously very adaptable in their feeding habits and not obligate predators. The adults are attracted to festering wounds of animals and to carrion for oviposition and probably also for feeding. Typically it is a secondary invader, preying upon the primary maggots in carrion and is beneficial in reducing the populations of other blow flies. This species is well known in this regard throughout its range and has been commonly associated as a predator on *Phaenicia cuprina* (Wiedemann) and *sericata* (Meigen) in sheep-strike myiasis in Australia.

In Hawaii it is associated, almost always, with *C. megacephala* in carrion but under some circumstances it may be a primary parasite of new-born calves (Shishido and Hardy 1969). On some ranches, especially on Maui and Kauai, in areas where the rainfall is 100 inches or more per year, this species definitely behaves as a parasite and causes serious damage to very young calves. The first record of this type of parasitism was by Holdaway (refer to Beaumont 1943). He reported blow flies attacking young calves and mentioned the species *Chrysomya megacephala*, *C. rufifacies*, and *Phaenicia sericata*. It is obvious, however, that the cases he reported are exactly the same as those we later investigated in detail and that his actual parasites were the “hairy” larvae of *rufifacies*. Holdaway recorded that there had been reports of losses of new-born calves by parasitism for a number of years and “a survey of the ranches of Kauai has shown that during 1940, strikes on young calves occurred in 16 ranches out of 29; 150 calves were struck, and 86, or 57 percent died. On the

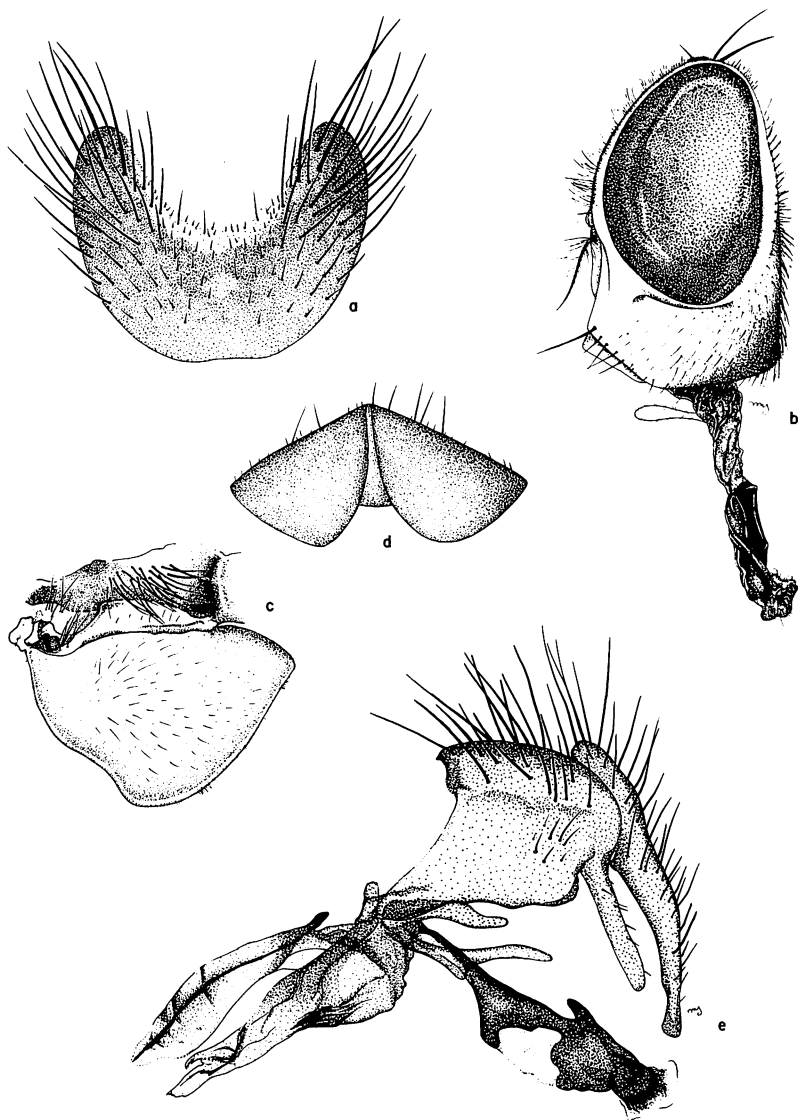


Figure 158—*Chrysomya rufifacies* (Macquart): a, fifth sternum of male, ventral; b, head, lateral; c, calypter, suprasquamal ridge and postalar declivity; d, fifth tergum of female, ventral; e, male genitalia, lateral.

ranches on which strikes occurred, 15.6 percent of the calves born were struck and 9 percent died.”

We (Shishido and Hardy 1969) have investigated this on ranches on the wet (north) slope of Haleakala, Maui, where some ranches have been losing as many as 10 percent of their new-born calves because of this blow fly. The vulnerable period for the animals is the first five days after birth.

The calves are usually struck shortly after birth, and unless the parasitism is detected and the calves promptly treated, the animal dies within approximately seven days after birth. The parasitism is peculiar in that the maggots attack only the dermis and the connective tissues; they literally eat the skin off large sections of the body and the calf dies of dehydration and possibly from the toxic effect of the maggots. Also, it is evident that after the calf has become heavily parasitized, the affected area of the skin becomes gangrenous and the smell of putrefaction causes the mother to abandon the calf so that starvation is also an important factor in weakening the animal. It seems apparent that the flies are attracted for oviposition to improperly cleaned calves. One of the ranchers felt strongly that new mothers, inexperienced in cleaning their calves, were largely involved in these cases. In other cases, cows neglectful of cleaning their calves are involved. It is probable that flies are first attracted to bits of placenta, remnants of foetal membrane, and the fluid of the foetal sac not totally licked off the calf by its mother. From our observations, most of the initial "strikes" are on the back and sides of the animal. The first instar larvae feed as scavengers on tissue remaining from the mother's afterbirth; the second and third instar larvae bore directly into the skin. Once the calf has been attacked, large numbers of adult flies are attracted for oviposition. Initially, strikes involve oviposition by both *rufifacies* and *megacephala*, however, after 1 to 3 days of infestation, larvae of *C. rufifacies* predominate. Larvae of *megacephala* feed only as scavengers and literally disappear or are found only in those areas not occupied by *rufifacies*. Within a matter of a few days, the major surface of the back and sides of an infested calf may be involved and the animal becomes progressively weaker. The adults are usually not attracted for oviposition to the umbilical cord or body openings until the calf is so weakened that it can no longer stand and is obviously dying. After about five days of parasitism, the adult flies do start ovipositing around the umbilical cord, around the eyes, nostrils, ears, and anus; the calf dies shortly after.

Zimmerman (1944) recorded a case of bovine auricular myiasis involving blow flies parasitizing a cow's ears which had been intensely irritated by spinose ear ticks. He considered the primary invaders to be *C. megacephala* and reared 275 specimens of this species and 39 specimens of *rufifacies*. If this was actual parasitism it is the first record we have for Hawaii of *Chrysomya* attacking older animals. Because of this report Zumpt (1965:93) assumed that the Old World screwworm fly (*C. bezziana* Villeneuve) was probably present in Hawaii.

It seems very probable that this might have been the species referred to by Van Dine and Norgaard (1908:44-45) and Van Dine (1909:21-22) as a new and very serious pest of sheep ("The Hawaiian sheep maggot"). First collected on Molokai and forwarded to Washington where it was determined by D. W. Coquillett as *Calliphora dux* (Esch.), "a species which is supposed to attack only dead animal tissue has suddenly adapted itself to living animals with serious results." They said this was an extremely serious pest of sheep and that the flies attacked any wounds on the animals, especially scab wounds and also laid their eggs in the dead wool and wool fouled by feces and urine. They noted

that the larvae do not penetrate the unbroken skin "but work in a constantly moving intermingled mass over the surface, causing irritation and ulceration, on the products of which the larvae feed. Then the wool drops off leaving a festering ulcer which is being constantly reblown, while masses of eggs are being deposited in the filthy wool surrounding the sore . . . when the skin is completely destroyed the maggots penetrate with ease in all directions under the skin, forming pockets, fistulas and sinuses and the animal dies from septicemia or exhaustion."

They referred to the above fly as a metallic, bluish green species; they were probably rearing both *megacephala* and *rufifacies* but the latter was not recognized in Hawaii until 1918 (Illingworth 1918), and the above description of the parasitism sounds very much like the way *rufifacies* works on new-born calves. Or it is entirely possible that *Phaenicia* may have been confused in this story. I have seen *rufifacies* maggots ex sheep from Hilo, Hawaii, November 1943.

The females of *rufifacies* produce unisexual progeny, that is, each female produces progeny of only one sex throughout her life (Roy and Siddon 1939, Norris 1959, in Keast et al.). A single male may fertilize several females, some of which will produce males only and some, females only.

The larvae are characteristically spinose, heavily sclerotized and hairy, with a transverse row of fleshy processes and a tuft of black spines on each process.

C. rufifacies is nearest to *albiceps* (Wiedemann) and was confused with that species, especially in Australia, until Holdaway (1933) demonstrated that they are distinct species. *C. rufifacies* is differentiated by lacking prostigmatic bristles and having two to four (usually three) propleural bristles, whereas *albiceps* has four to six. Also, the male genitalia are supposed to differ (refer to fig. 68, Senior White et al. 1940 for genitalia of *albiceps*).

Differentiated from *megacephala* (Fabricius) by being typically smaller; the body, coppery green; mesothoracic spiracles, white; the ground color of the bucca tinged reddish brown to black but completely obscured by dense gray pollen; bucca, white pilose; outer vertical bristle present in male; the fronto-orbitals lacking in female; eyes of male separated on front, at narrowest point frons equal to five rows of eye facets; head shaped as in figure 158b. Facets of lower portion of eye not noticeably smaller than those of upper portion. Upper squamal ridge rather sparsely pale pilose (fig. 158c). The fifth sternum of male and the genitalia are very different in the two species. In *rufifacies*, the concavity on the posterior margin of the fifth is very shallow, so the lobes are short (fig. 158a). The cerci and the surstyli are much more slender, very different in shape (fig. 158e). The fifth tergum of female is deeply cleft in middle of hind margin in *rufifacies* (fig. 158d) and entire in *megacephala*.

Length: body, 7.0-9.5 mm.; average, 8.0-8.5 mm.

Tribe PHORMIINI

Characterized by having the calypter rounded at apex, bare above, and prealar callus bare, except for short pubescence. The hind coxae are bare

posteriorly and two presupraalar bristles present, except in *Phormia*. The larvae of Phormiini have no "button" on the postspiracular plate. These are dull black or dark blue to olivaceous green or bluish green flies with entirely black heads.

Only one genus and species present in Hawaii.

Genus **PHORMIA** Robineau-Desvoidy

Phormia Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2)2:465. Type-species, *Musca regina* Meigen, by subsequent designation (Robineau-Desvoidy 1849:v).

Euphormia Townsend, 1919, Proc. U. S. Nat. Mus. 56:542. Type-species, *Musca regina* Meigen, by original designation.

This genus fits near *Protophormia* Townsend and *Protocalliphora* Hough but is differentiated by having the mesothoracic spiracle orange, rather than dark brown to black; mesonotum convex, rather than flattened; and presutural acrostichal bristles well developed, rather than weak or absent. The supra-squamal ridge is bare and the postalar declivity setose.

A monotypic genus.

Phormia regina (Meigen) (figs. 159a,b)

The Black Blow Fly

Musca regina Meigen, 1826, Syst. Besch. bekannt. europaisch. Zweifl. Ins. 5:58.

For synonymy refer to Hall, in Stone et al. (1965:924).

Kauai, Oahu, Maui, Hawaii, probably on all the main islands at elevations above 3,000 ft. First recorded by Howard (1901) and Grimshaw (1901:28) from Hawaii.

Immigrant. Widespread over Holarctic Region, over entire U. S. to Mexico and Hawaii.

Bionomics. Scavengers, predominantly carrion breeders "but can be facultative producers of myiasis of mammals and birds" (Greenberg and Povolny, in Greenberg 1971:77). James (1948:76) says: "Although this is one of the species that has been used in maggot treatment of wounds, it not uncommonly invades healthy tissue. It is a common sheep maggot in the Southwest and in certain localities may be more important as such than *Callitroga americana* during the spring and fall months. Cases of traumatic dermal myiasis in man have been recorded; it has also been reported in enteric myiasis, although the record needs substantiation." This species may possibly have been involved in some of the cases of sheep parasitism, which was a serious problem during the early part of the century. Specimens on hand were reared "ex sheep wool" on Hawaii, and a series were reared ex open wound in eye of cow, Parker ranch, Hawaii (Hardy 1971).

Most of the specimens have been collected around 6,000 ft. elevation and it

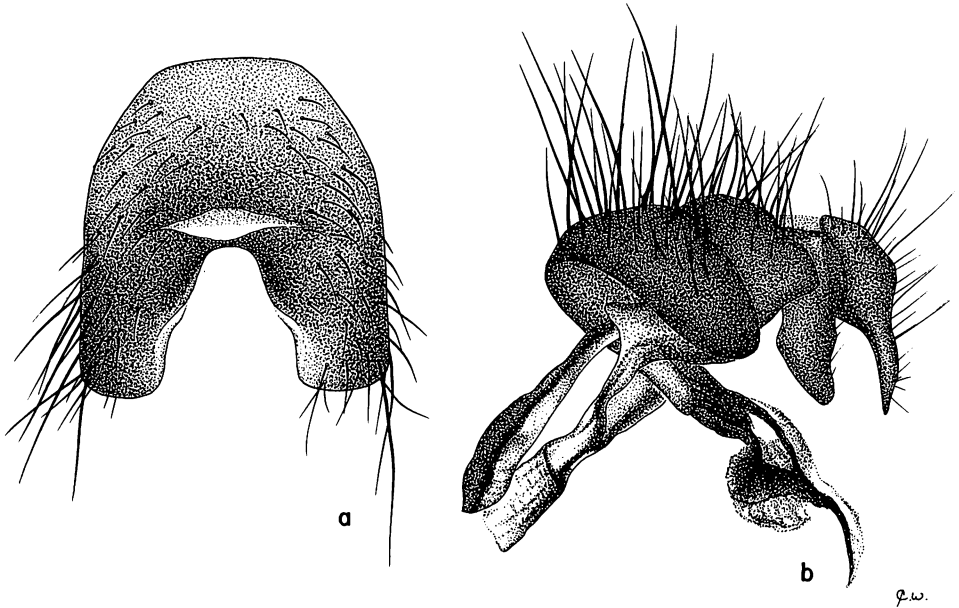


Figure 159—*Phormia regina* (Meigen): a, fifth sternum of male; b, male genitalia, lateral.

has been taken up to 10,000 ft. on Haleakala, Maui. It evidently breeds largely in carcasses of goats and other feral animals at higher elevations, temperate climate regions, along with *Calliphora vomitoria* (Linnaeus) and *Eucalliphora lilaea* (Walker).

Eyes bare, narrowly separated on front in male; frons, at narrowest point, scarcely over half as wide as ocellar triangle and about equal in width to four rows of eye facets. Frons of female about $\frac{1}{3}$ width of head. The mesothoracic spiracle is elongate and covered with bright orange hair.

Differentiated by the dark blue to nearly black body, sometimes with a slight greenish sheen; base of radius haired below; lower calypter bare and prealar callus bare except for short pubescence. The lower calypter is slightly longer than wide and the upper is about half as long as lower. The fifth sternum of male as in figure 159a and male genitalia as in figure 159b.

Length: body, 6.0–10.0 mm.

For detailed descriptions refer to Hall (1948:161) and to Kano and Shinonaga (1965:111).

Subfamily POLLENIINAE

Dull black, nonmetallic, thinly silvery gray pollinose flies. Characterized by having the propleura, prosternum, and base of radius bare and the parafacials densely setose to below eye margin. The basal section of radius is bare.

Tribe POLLENIINI

Differentiated from Melanodexiini by having the scutellum broad, flattened on the disc, also hind portion of mesonotum flattened. Presutural intraalar and posthumeral bristles present. Calypters bare above and thorax usually densely covered with golden, crinkly hair.

Only one genus and species in Hawaii.

Genus **POLLENIA** Robineau-Desvoidy

Pollenia Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2)2: 412. Type-species, *Musca rudis* Linnaeus, by original designation.

Characterized by the subfamily and tribal characters above. Differentiated from related genera in other areas by having parafacials densely setose to below eye margin, and facial carina undeveloped. In Hawaii, the dull black, thinly silvery pollinose body and the dense covering of golden, crinkly hair over the thorax will readily differentiate it from other calliphorids.

Pollenia rudis (Fabricius) (figs. 160a-d)

The Cluster Fly

Musca rudis Fabricius, 1794, Ent. syst. emend. et aucta 4:412.

Musca familiaris Harris, 1869, Occas. Papers Boston Soc. Nat. Hist. 1:336.

Musca obscura Bigot, 1887, Ann. Soc. Ent. de France, ser. 6, 7(Bul.):clxxxi.

Musca hirticollis Harris, 1835, VIII, Insects, in Hitchcock, E., Report on the geology, mineralogy, botany, and zoology of Massachusetts, p. 599.

Oahu, Kauai, Hawaii.

Immigrant. Nearctic and Palaearctic regions, North Africa. First reported on Oahu, October 1955, by C. R. Joyce (1956). It was first reported on the island of Hawaii at Kamuela, April 1968 (Joyce 1969), and has since become very abundant and at times, pestiferous, especially at elevations of 2,000–5,000 ft., on that island. It has been reported down to sea level on Hawaii (Yoshioka 1970). Reported on Kauai, July 1970 (Kawamura 1971), and specimens are in the Bishop Museum collection taken on Kauai, 1959 and 1961 (Howarth 1971).

Bionomics and economic importance. A parasite of earthworms and notorious throughout the Holarctic Region, where it is often very pestiferous because of its habit of entering houses and other buildings in the autumn, looking for a place to spend the winter and again in the spring, when they seek ways to the outside. Large populations often occur and they become very bothersome through their sheer numbers and noisy buzzing.

This species periodically becomes very abundant and at times, especially in early winter and spring of 1970–1971, has been very pestiferous on the island of Hawaii, especially in the Kilauea and Kamuela areas, 2,000–4,000 ft. elevation.

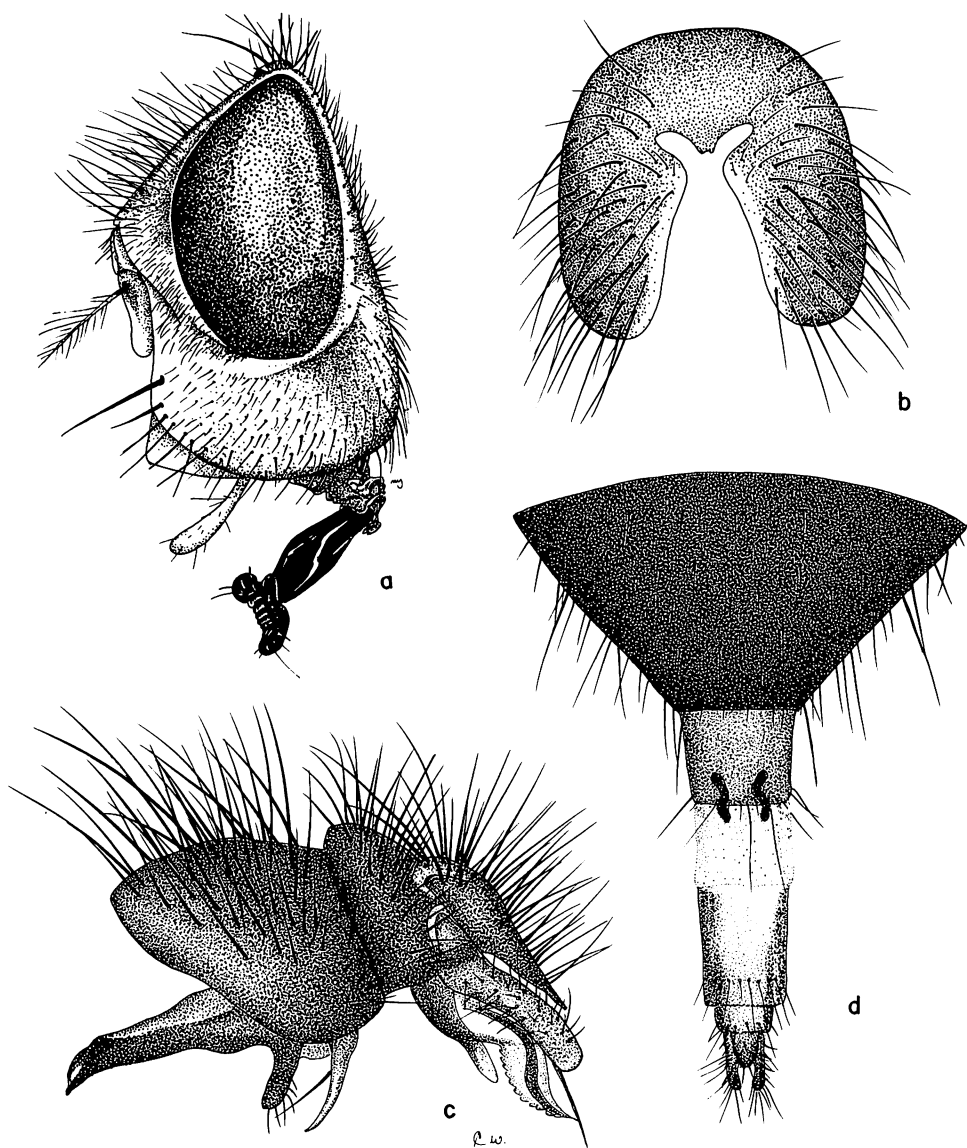


Figure 160—*Pollenia rudis* (Fabricius): a, head of male, lateral; b, fifth sternum of male, ventral; c, male genitalia, lateral; d, apical portion of female abdomen, dorsal.

Detailed biological and ecological studies were made 1970–1971 on the island of Hawaii by Mr. F. A. Bianchi (unpublished report). He reared adults from the earthworm *Allolobophora caliginosa* (Savigny) from several localities on the island of Hawaii. The host worms occur from 2,000–6,000 ft.

It has been observed in the Pohakuloa region of Hawaii, 6,500 ft., that the

adult flies are strongly attracted to the flowers of the endemic “naio” trees (*Myoporum sandwicense*). According to Matayoshi Shin (*in litt.*), nearly every branch terminal was literally covered by cluster flies. They appeared to be feeding on nectar of the flowers, the tiny soft and succulent ripe fruits, and perhaps even the tender terminal growth of the branches themselves.

For details on biology (not Hawaii) refer to Keilin (1911), Pimental and Epstein (1960), and Yahnke and George (1972). The larvae feed only on specific earthworms. During first two instars, they feed as internal parasites and during third instar, as a predator from outside the host.

P. rudis is differentiated from other calliphorids in Hawaii by the characters given under the generic discussion.

A moderate sized species, with body length ranging from 6.0–12.0 mm., but in Hawaiian populations, typically 8.0–9.0 mm. Front rather narrow in male, broad in female. At narrowest point, frons of male equal in width to 8–9 rows of eye facets. Margins of frons strongly divergent anteriorly. Interfrontal area reduced to just a thin narrow line at narrowest portion of frons. Chaetotaxy and shape of head as in figure 160a. Compound eyes about two times higher than long. All body appendages black, except for the yellow-rufous halteres. Suprasquamal ridge bare, postalar declivity with a clump of long yellow hairs. Calypters entirely yellow-white. The upper lobe extends less than half the length of the lower. Subcostal sclerite orange-brown, densely short, yellow pubescent. Basicosta black. Abdomen subshining black in ground color, densely covered with silvery pollen but with irregular patches of black in a tessellated pattern, somewhat resembling that of *Muscina stabulans* (Fallén). The fifth sternum of male is as in figure 160b and male genitalia as in figure 160c. For a more detailed description refer to Hall (1948:344). The female ovipositor as seen from dorsal view is as in figure 160d.

Subfamily RHINIINAE

The single representative of this subfamily in Hawaii is readily recognized by the protuberant epistoma (fig. 161e), arista plumose only dorsally, very narrow occipital orbits which are bare except for the occipital row of setae, and by their predominantly rufous abdomen and legs. The base of radius is ciliated above (fig. 161a,c).

Bionomics. The adults often visit flowers. Very little is known about their biologies or habits. Senior White et al. (1940:149–150) says: “Some species hover in swarms at certain seasons, like Syrphidae. Opening up a termitarium attracts others that are otherwise seldom seen, but of not a single species is the life history completely known. . . . They do not frequent food or filth, but it is not impossible that some of them are, in their larval stages, parasitic.” He also recorded (p. 194) rearing *Stomorphina discolor* (Fab.) from an ant nest and said the adults are attracted to freshly opened ant nests.

As reported by Hall (1948:93–94), *Stomorphina lunata* (Fab.) larvae are predaceous upon grasshopper eggs in Europe, Africa, and India and have also

been reared from "soil beneath dung heaps infested with termites, also from larvae associated with dead and dying termites in the broken down fungus beds of a termite nest."

Zumpt (1958:4) says that "very little is known about the bionomics of the Rhiniini, but all of them seem to be associated with developing stages of insects, especially termites, hymenoptera and orthoptera on which the larvae feed as predators or parasites."

Peris (1952) has revised this subfamily on a worldwide basis.

Genus **RHINIA** Robineau-Desvoidy

Rhinia Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2) 2:422. Type-species, *testacea* Robineau-Desvoidy, by original designation, = *apicalis* (Wiedemann).

Beccarimya Rondani, 1873, Ann. Mus. Civ. Stor. Nat., Geneva 4:287. Type-species, *glossina* Rondani, by original designation, = *apicalis* (Wiedemann).

Fitting close to *Stomorphina* Rondani but differentiated by having cell R₅ closed and petiolate (fig. 161a); mesopleuron densely yellow pollinose, the dark ground color completely obscured; sternopleuron polished black and abdomen mostly yellow. Zumpt (1958:111) says: "The *Rhinia*-species represent a specialized branch of the *Stomorphina* complex with pincer-like cerci and paralobi and a denticulated fifth sternite in the male sex."

Only one species present.

Rhinia apicalis (Wiedemann) (figs. 161a-g)

Idia apicalis Wiedemann, 1830, Aussereurop. zweifl. Ins. 2(3):354.

For synonymy refer to James (1962:124).

This has been referred to in the Hawaiian literature as *Stomorphina pleuralis* (Thomson) and as *Rhinia testacea* Robineau-Desvoidy.

Widespread over all the main islands, especially in the lowlands. First recorded in Hawaii by Grimshaw (1902:83) as *Rhinia testacea*. Perkins (1913:187) said it first appeared in Hawaii in 1900 and "at once became very common."

Immigrant. Widespread throughout Africa, Asia Minor, southeastern Asia, Solomon Islands, Fiji, Philippine Islands, Micronesia, and Hawaii (James 1962:124).

Bionomics. This species is evidently a predator on other insects in the larval stage, there is no definite information available concerning the feeding habits. Cuthbertson (1938), in Africa, has observed oviposition in the soft earth which driver ants excavate from their nests and in soil rich in humus and indicates the larvae are parasitic on driver ants (*Dorylus*) and also on sand wasps (*Bembex melanopa* Hand.).

Bohard and Gressitt (1951:132) found this species (as *testacea*) most commonly along beaches and in coastal villages on Guam and on Florida Island in

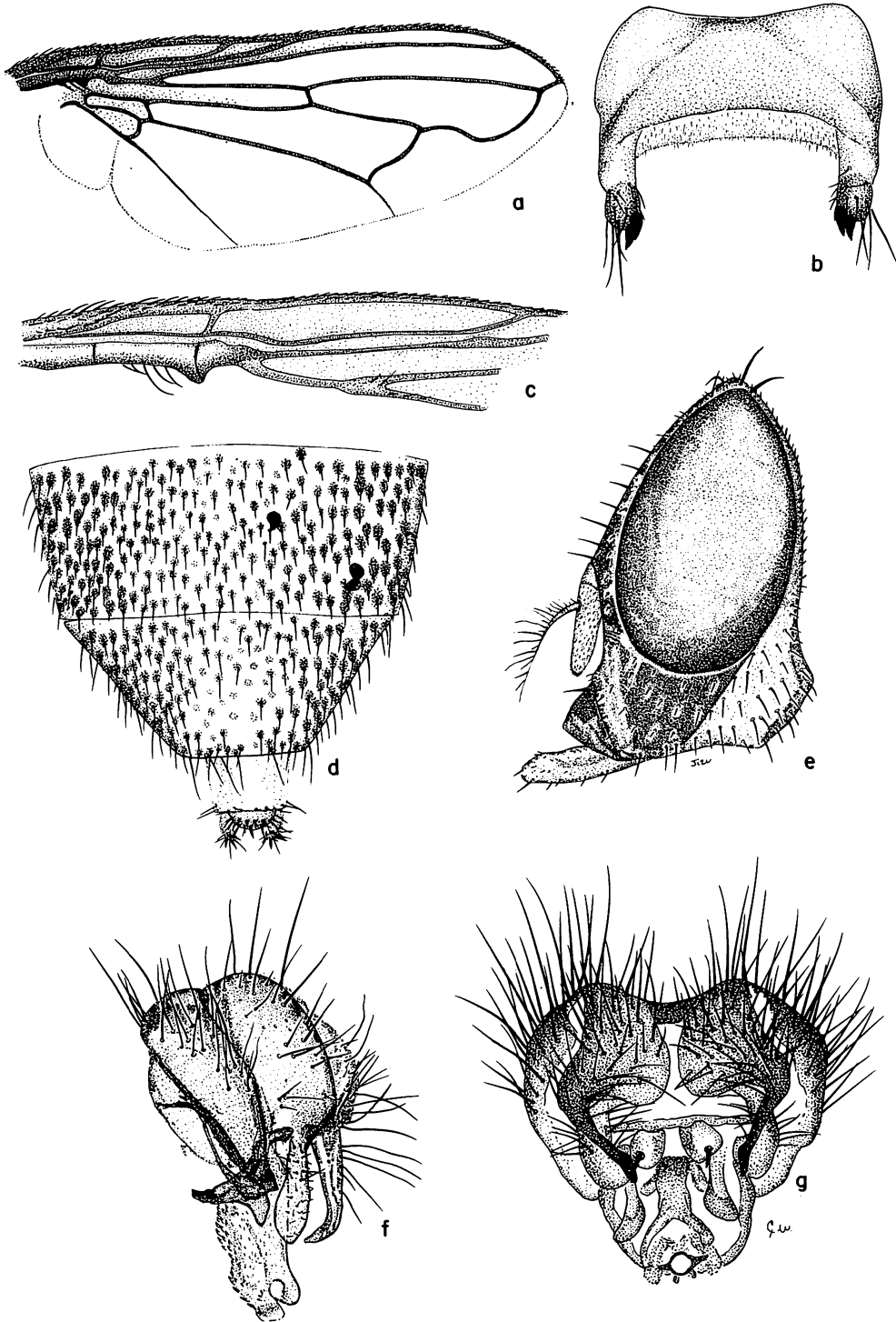


Figure 161—*Rhinia apicalis* (Wiedemann): a, wing; b, fifth sternum of male, ventral; c, anterior portion of wing showing base of radial veins; d, abdomen of female, dorsal; e, head, lateral; f, male genitalia, lateral; g, male genitalia, end view.

the Solomons. They reported that the adults were strongly attracted to carrion of all kinds and "a number of flies were seen to deposit eggs in beach sand where leftovers from picnics and small dead beach animals were scattered."

No biological data are available in Hawaii. The adults are commonly seen on flowers, along beaches, and on the ground in picnic areas.

Readily differentiated from other calliphorids in Hawaii by the characters given under the subfamily above.

Head: As in figure 161e. Anterior half of each gena, lower parafaciale, lower face, and epistoma polished black; the gena with short, inconspicuous, scattered, brown to black setae. Hind portion of gena and occiput densely yellow-gray pollinose, covered with yellow pile. Eyes of male rather closely approximated on front, frons at narrowest portion about half as wide as ocellar triangle and equal in width to 3 to 4 rows of eye facets. In female, the frons is about one-fourth the head width. Parafrontalia of female gray pollinose with moderately large, shining, black setiferous spots. Interfrontal area subopaque, dark reddish brown to black, about two times wider than a parafrontale. Thorax dark metallic green or blue-black in ground color with a gray-white pollinosity over mesonotum and numerous opaque black piliferous spots. All setae of mesonotum black. Pleura yellow pilose. Upper half of each pleuron densely yellow-gray pollinose. Sternopleuron polished black on upper two-thirds, gray pollinose on ventral portion. Legs entirely yellow. Wings mostly hyaline, slightly infuscated in upper anterior portion and yellowed basally, venation as in figure 161a. Base of radius with four or more yellow hairs on posterior portion above (fig. 161c), and base of vein $R_4 + 5$ with a few short black setae. Calypters pale yellowish, broadly rounded, with upper about one-half as long as lower. Suprasquamal ridge and postalar declivity bare. Abdomen predominantly yellow to rufous, with terga 4 and 5 often mostly brown to black and sometimes with a narrow brown to blackish vitta extending down middle of terga 1-3. The amount of black or dark coloration on posterior portion of abdomen varies considerably. Tergum 1 + 2 mostly yellow setose, with black setae along posterior margin; otherwise abdomen black setose. Sides of terga 2-4 with small, brown, setiferous spots. Fifth sternum of male with a pair of strong black teeth at apex of each lobe (fig. 161b) and cerci strongly forcipate as seen in end view (fig. 161g). As seen in lateral view the lobes of the cerci are bent sharply downward at almost a right angle at their tips and the surstyli are clavate (fig. 161f). Female ovipositor as in figure 161d.

Length: body, 6.0-7.0 mm.

For a more detailed description refer to Zumpt (1958:112).

Family SARCOPHAGIDAE

Flesh Flies

Mostly moderately large, gray-bodied flies with three black vittae down mesonotum and with a checkered or tessellated pattern of black and silvery gray on the abdomen. They more nearly resemble Muscidae than other calyp-

trates and are readily differentiated by the presence of a row of hypopleural bristles and by the wing venation, as well as by their very different body build ("gestalt"). The sarcophagids have been (and are being) treated as a subfamily of Calliphoridae by some authors, following Curran (1934), Séguy (1941), Senior White et al. (1940), Oldroyd (1949), Hennig (1952), and Zumpt (1956). I prefer to treat these as families following Lopes (1941, 1958, 1961a, 1961b, 1969); Hall (1947); Hall and Downes, *in* Stone et al. (1965); Kano et al. (1967, 1968); Colless and McAlpine (1970); and Lopes et al., *in* Delfinado and Hardy (1977).

The sarcophagids are differentiated from calliphorids by the gray non-metallic bodies, usually with black vittae down mesonotum and a checkered or tessellated pattern of black and gray or silver on abdomen; the outer post-humeral bristle, if present, never distinctly lateral to the presutural bristle; no cilia present between eye margin and the row of postocular setae; propleuron and prosternum usually bare or rather sparsely pilose, never with long and densely placed pile or hair; arista plumose, pubescent or bare, with the apex always bare. The cephalopharyngeal skeleton of the larva has the dorsal cornua divided or deeply incised; the posterior spiracles are usually in a deep concavity and the peritreme usually open and the "button" indistinct or absent.

Downes (1955) indicated that the alphasetae (a pair of minute, transparent setae at anterior margin of each of abdominal sterna 2-5) are present in Calliphoridae and absent in Sarcophagidae.

These flies normally deposit hatched first instar larvae, "though some eggs may be deposited when the mother fly has exhausted its supply of newly hatched maggots on an especially favorable medium (James 1969:251). They usually breed in carrion or animal dung, although some species breed in decaying vegetable matter and some are parasites of several kinds of insects, spiders, mollusca, and other invertebrates. A number of species have been incriminated as causative agents in facultative traumatic and other types of myiasis in man and animals (refer to James 1948 and Zumpt 1965).

Following the work of Rohdendorf (1937), the subfamily and tribal classification has been based largely upon the nature of the postabdomen of the male and the generic and subgeneric classification upon the male aedeagus. To a complete outsider, it would seem that the genus *Sarcophaga* has been split ultra finely and, in light of the extensive knowledge we now have on a somewhat similar (but smaller scale and local rather than worldwide) situation in the genus *Drosophila* in Hawaii, it would make one wonder if many of these might not best be considered species groups, or in the case of "subgenera," as species complexes (refer to Kaneshiro 1976).

For generic classification of the sarcophagids refer to Rohdendorf (1937 and 1965), Roback (1954), and Kano et al. (1967).

For arrangement of the higher categories, I have followed Lopes et al., *in* Delfinado and Hardy (1977), with advice from Dr. H. de Souza Lopes and R. Kano (*in litt.*). The sarcophagids recorded from Hawaii fit into three subfamilies, four tribes, thirteen genera, four subgenera, and seventeen species.

KEY TO GENERA AND SPECIES OF SARCOPHAGIDAE KNOWN FROM HAWAII

1. Arista bare. Hind coxa bare on posterobasal portion. Third and fourth sterna covered by sides of terga, only two free sterna 2
- Arista plumose. Hind coxa with fine hairs posterobasally. Abdominal sterna exposed, 4 free sterna. Mesonotum gray with three black, longitudinal vittae (very faint in *Sarcophagula*). Sarcophaginae 3
- 2(1). Head hemispherical, eyes very large, and occiput concave behind. Parafrontals with numerous thin hairs in two or more rows in addition to the row of incurved bristles (fig. 162b), but lacking proclinate orbital bristles in either sex. Mesonotum gray with three dark brown to black vittae. Notopleura with numerous bristle-like setae. Costal spine absent. Male genital segments reduced, first genital tergum with only one pair of large setae (fig. 162a) . . . Miltogramminae
- ***Amobia pelopei*** (Rondani).
- Head subquadrate, eyes normal and occiput convex. Parafrontals with scattered, short setae and with two pairs proclinate orbitals in female (fig. 163c). Mesonotum not vittate. Notopleura bare except for the two bristles and a few short setae. Costal spine strong. Male genital segments well developed, the first with four strong basal and two preapical bristles (fig. 163d) . . Agriinae
- ***Goniophyto bryani*** Lopes.
- 3(1). Vein R_1 setose, $R_4 + 5$ setose almost to r-m crossvein . . . 4
- Vein R_1 bare, setae of $R_4 + 5$ not extending near r-m . . . 6
- 4(3). Propleura bare, dorsocentral bristles strong, about equal to or larger than notopleurals. 5
- Propleura setose. Presutural dorsocentrals and the two anterior postsutural pairs much smaller than notopleurals. Male and female genitalia as in figures 174a-d
- ***Phytosarcophaga gressetti*** Hall and Bohart.
- 5(4). With only three, evenly spaced, strong dorsocentral bristles. Male genitalia usually red, shaped as in figure 168a. Female with a vertical, plate-like, sclerotized area immediately beyond fifth tergum (fig. 168c), the sterna rather small, narrow, the

- last not bearing an elongate process on inner lateral margin. **Helicobia morionella** Aldrich.
- With four postsutural dorsocentrals. Evidently parthenogenetic, males not known. Female lacking the sclerotized plate beyond fifth tergum. The sterna are transversely oval with the seventh being the largest (fig. 164b) and the last bearing an elongate setose appendage on inner lateral margin (fig. 164d). **Chaetoravinia anandra** Dodge.
- 6(3). Propleura bare. 7
- Propleura setose in middle but sometimes sparsely so. Ventralia (preapical, ventral swelling on aedeagus) globose, large, membranous, bilobed, covered with numerous spinules (fig. 167c). **Boettcherisca peregrina** (Robineau-Desvoidy).
- 7(6). Hind femora of male not spined on ventral surface. Genital segments normal in size in both sexes 8
- Hind femora of male with strong, spine-like, ventral bristles. Male genital segments very large, robust, red (fig. 169a). Female genital sternum (6th) almost as large as terga (fig. 169e). **Hystriocnema plinthopyga** (Wiedemann).
- 8(7). Presutural acrostichal bristles strong 9
- Presutural acrostichals weak or absent 11
- 9(8). Rows of frontal bristles diverging below. Epaulet black. Male genitalia black, inconspicuous. Eighth tergum of female not divided. **Blaesoxipha** Loew. 10
- Rows of frontal bristles parallel. Both epaulet and basicostal scale yellow. Male genitalia red, very conspicuous. Female eighth tergum conspicuous, composed of two lateral, crescent-shaped plates (fig. 165g). **Ravinia (Ravinia) iherminieri** (Robineau-Desvoidy).
- 10(9). Rather small species, body, 4.5–5.5 mm. Arista equal or longer than anterior vibrissal bristle and plumose on basal 2/3. Median pair of marginal bristles on third tergum large, about as long as the segment. Lobes of male cerci rather gradually divergent (fig. 177b). **filipjevi** (Rohdendorf).
- Larger species, body, 7.0–9.0 mm. Arista shorter than anterior vibrissal bristle and plumose well

- beyond middle. Median marginal pair of bristles on third tergum much shorter than the segment. Lobes of cerci rather strongly divergent (fig. 178b) **lineata** (Fallén).
- 11(8). Antennae gray or black and at least apical portions of palpi tinged with black and covered with gray pollen 12
 Antennae and palpi red. Postabdomen reddish orange in both sexes . . . **Parasarcophaga (Liopygia) ruficornis** (Fabricius).
- 12(11). Moderately large, 8.5–15.0 mm. in length and with prominent black vittae on mesonotum. Eyes of males closer together on front than in females, no proclinate fronto-orbitals in males and two pairs in females. Frontal bristles diverging below 13
 Tiny species, body, 3.0–5.0 mm., with very faint vittae on mesonotum. Only two humeral and two notopleural bristles. Eyes of male about as far apart as in female and with a pair of strong, proclinate orbital bristles in both sexes and the frontal rows of bristles parallel
 **Sarcophagula occidua** (Fabricius).
- 13(12). Second male genital segment (epandrium) and female genital segments red 14
 Genital segments of both sexes black or reddish black 15
- 14(13). Genae with black setae anteriorly. Theca of penis much reduced (fig. 166d). Female genital tergum with hind margin excised at middle. Acrostichal bristles absent. Lobes of cerci (from behind) long, widely divergent, narrow, pointed (fig. 166a). . . .
 **Bercaea haemorrhoidalis** (Fallén).
 Genae with a few black setae near eyes only. Theca of penis elongate. Female genital tergum with margins entire. Prescutellar acrostichals present. Lobes of cerci short, blunt, not widely diverged (fig. 173b)
 **Parasarcophaga (Thomsonia) argyrostoma** (Robineau-Desvoidy).
- 15(13). Lobes of cerci (anal forceps) without a preapical tuft of hairs (figs. 170b, 172a). Abdominal sterna not densely villose. Fifth sternum of male densely setose along inner margins (figs. 170d, 172b).

- Female tergum 6 + 7 divided down middle (figs. 170c, 172c), as seen from end view, the sides of the tergum are divergent. 16
- Lobes of cerci with a preapical dorsal tuft (fig. 175b). Abdominal sterna 3 and 4 densely haired (fig. 175c). Fifth sternum with a densely blunt-spiculated knob on inner apical margin (fig. 175d). Female tergum 6 + 7 entire, not divided, sides folded so they are nearly parallel when seen in end view **Seniorwhitea krameri** (Boettcher).
- 16(15). Ventralia of aedeagus pedunculate (fig. 170b). Male cerci each strongly narrowed on inner margin just before apex (fig. 170a). Back of head with one or two rows of black hairs in addition to the postocular row. Female tergum 6 + 7 interrupted in middle, divided into two plates (fig. 170c). Hind margin of female tergum 8, straight (fig. 170e)
- **Parasarcophaga (Parasarcophaga) albiceps** (Meigen).
- Ventralia not pedunculate. Inner margin of cercus uniformly tapered to a point. Back of head with only postocular row of cilia black, remaining hairs white. Female tergum 6 + 7 with a line down middle but not divided into two separated plates (fig. 172c). Eighth tergum of female concave on hind margin (fig. 172d)
- . . **Parasarcophaga (Liosarcophaga) misera** (Walker).

Subfamily MILTOGRAMMINAE

According to Downes, *in* Stone et al. (1965:933), the larvae of members of this tribe feed predominantly on provisions in the nests of bees and wasps. Townsend (1935:201) says the flies of this tribe "larviposit on the stored food supply in nests of burrowing wasps, bees and mud daubers or drop their maggots in the burrows while hovering in the air. The maggots feed externally on the grubs of the nest makers and on or even inside the comatose or decomposing insects with which the nests have been stored. . . . The maggots of the forms that breed in mud dauber nests pupate within the mud cells, the flies escaping through the thin partition walls between the cells until they find a host exit through the heavy outer wall."

According to Zumpt (1952:1), this group (he treated it as a tribe under Sarcophaginae) is differentiated by having the postabdomen of male consisting "of 3 free segments, the 6th not fused with the united 7th and 8th segments. Arista bare, or with short pilosity. Frons usually with a distinct angle in the

profile, if not, epistome protruding. Frons in both sexes of about the same width." According to Lopes et al. (*in* Delfinado and Hardy 1977), *Amobia* fits in the tribe Senotainini, subtribe Amobiina.

For a revision of the subfamily from Japan refer to Kurahashi (1970).

Genus **AMOBIA** Robineau-Desvoidy

Amobia Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (Ser.2) 2:96. Type-species, *conica* Robineau-Desvoidy, by monotypy, = *signata* (Meigen).

Ammobia Bezzi and Stein, 1907, *in* Becker et al., *Katalog der palaearktischen Dipteren* 3:519 (preocc. Billberg, 1820), emend.

Pachyophthalmus Brauer and Bergenstamm, 1889, K. Akad. der Wiss. Wien, Math.-Nat. Cl. Denkschr. 56(1):117. Type-species, *Tachina signata* Meigen, by monotypy.

For other synonymy and notes on Indoaustralian species refer to Kurahashi (1974).

This genus is differentiated by the bare arista; hemispherical-shaped head and large eyes (fig. 162b); costal spine absent; suprasquamal setae absent; hind coxae bare posteriorly.

According to Downes, *in* Stone et al. (1965:934), the larvae of *Amobia* develop on provisions in the nests of sphecoid wasps such as *Sceliphron* Klug and *Trypoxylon* Latreille and vespids such as *Symmorphus* Westmael and *Stenodynerus* Saussure.

Amobia pelopei (Rondani) (figs. 162a-d)

Sphixapata pelopei Rondani, 1859, Dipt. Ital. Prodr. 3:228. Type-locality: Italy.

Pachyophthalmus auriceps Baranov, 1935, Vet. Arch Zagreb 5:558.

Senotainiella decolor Zumpt, 1952, Proc. R. Ent. Soc. Lond. (B) 21:14.

Pachyophthalmus alienus Dodge, 1953, Proc. Haw. Ent. Soc. 15:131. Type-locality: Oahu Country Club, Oahu. Type male in U. S. National Museum.

Amobia sp. Swezey, 1951, Proc. Haw. Ent. Soc. 14:221.

Oahu. Immigrant. Widespread over Oriental Region, south Pacific, Australia, southern Africa, southern Europe, and Turkestan (refer to Kurahashi 1974:58).

Very probably introduced into Hawaii in the mud nests of its host on equipment or vehicles returned from the southwest Pacific region after World War II. First reported by Swezey (1951), October 1950.

Bionomics. Swezey (1951) reared it from nest of *Eumenes latreillei petiolaris* (Schulz). It has also been reared from *Eumenes* nests and from *Sceliphron caementarium* (Drury) in several locations over Oahu (Hardy 1952b:477). This species is larviparous.

According to Dodge (*loc. cit.*), this is differentiated from "typical European

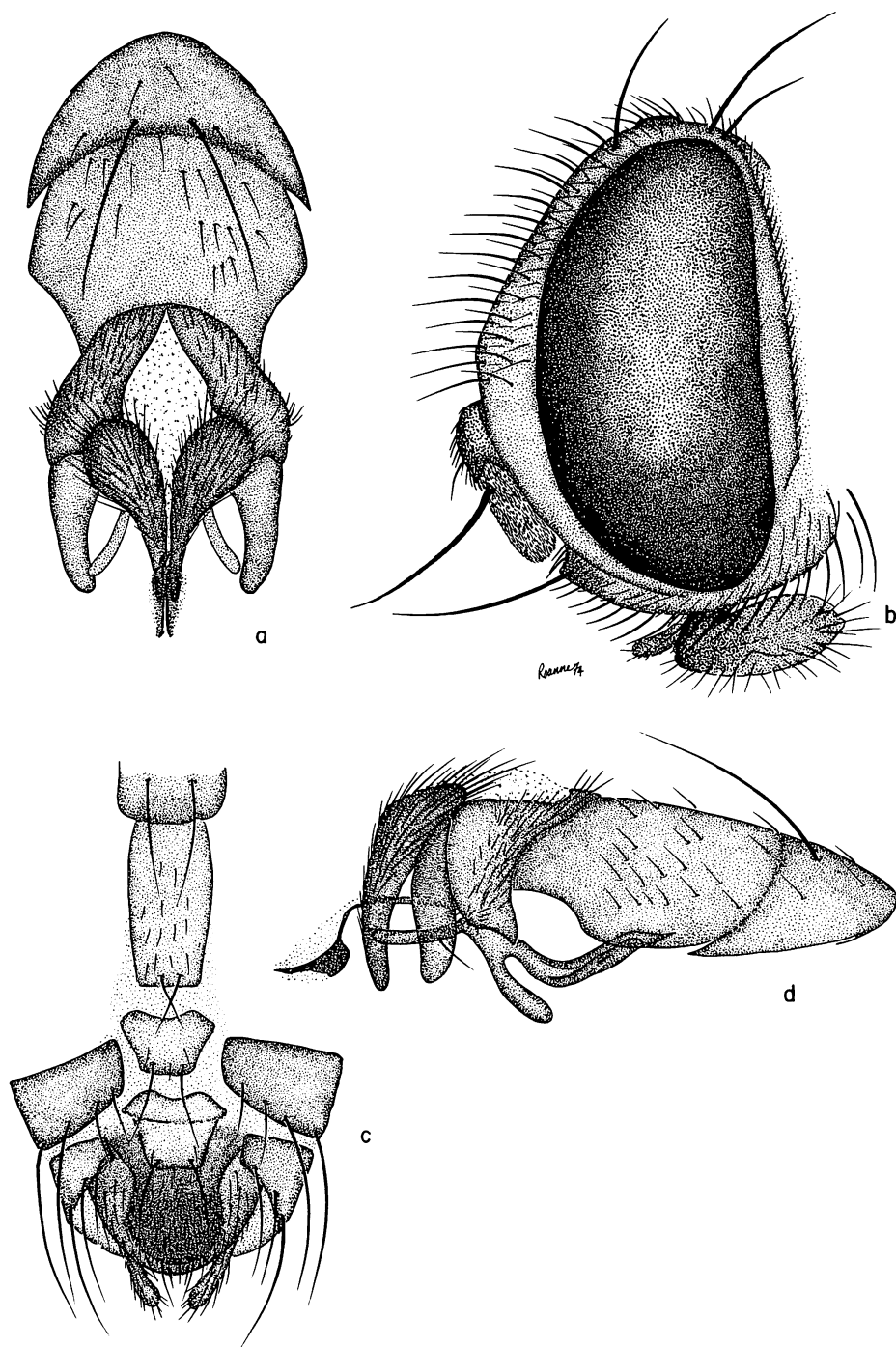


Figure 162—*Amobia pelopei* (Rondani): a, male genitalia, dorsal; b, head, lateral; c, female abdomen, ventral; d, male genitalia, lateral.

and North American species by the absence of the anterior acrostichal bristles and by the presence of numerous coarse [bristle-like] hairs on the notopleura, in addition to the usual two notopleural bristles. It differs also in genital features, but most closely resembles *P. floridensis* Townsend in this respect." Kurahashi (1974:57) separates it from *distorta* (Allen) and *quatei* Kurahashi (from the Oriental Region) by lacking presutural acrostichals; notopleura with numerous, coarse hairs; basicosta usually brown and by the differences in the male genitalia. Dodge (*loc. cit.*) says: "An Australian relative, *Austrometopia burnsi* Malloch, is also a parasite of *Eumenes* and has numerous hairs on the notopleura, but is distinguished by the setulose propleuron."

According to Dodge (*loc. cit.*), this "is easily distinguished from other sarcophagids of the region by the bare arista, concave occiput, hind coxae bare posteriorly, infrascapular setulae absent, and the presence of two rows of hairs on each parafrenal in addition to the usual row of bristles."

The head is shaped as in figure 162b and the genitalia of the male and female as in figures 162c,d. The pregenital tergum of the male with a pair of prominent bristles in middle (fig. 162a).

Length: body, 7.0-8.5 mm.

For a more detailed description refer to Kurahashi (1974:58) and to Dodge (1953:131).

Subfamily AGRIINAE

Members of this subfamily are differentiated largely by the characteristics of the postabdomen of the male. The first genital segment is large, about two times larger than the epandrium and consists of the fused terga 6-8 and has two transverse rows of strong bristles (fig. 163d). Aristae bare (fig. 163b) and hind coxae bare posteriorly. The frons in both sexes are about the same width.

Only one genus and species represented in Hawaii.

Genus **GONIOPHYTO** Townsend

Goniophyto Townsend, 1927, Ent. Mitt. 16:281. Type-species, *formosensis* Townsend, by original designation.

The diagnosis of *Goniophyto* by Lopes (1938:194) is as follows: "Resembling *Agria* Desv. mainly in the shape of male abdomen. First two arisal joints elongate. Fronto-orbital bristles proclinate in both sexes (sometimes minute in *G. bryani* n. sp.). Costal spine strong. Fifth sternite entire in male. Abdomen of male truncate at apex and first genital segment with two rows of bristles."

One species is endemic to the Northwestern Hawaiian Islands.

Goniophyto bryani Lopes (figs. 163a-e)

Goniophyto bryani Lopes, 1938, Occ. Papers B. P. Bish. Mus. 15(11):195.

Northwestern Hawaiian Islands (type-locality: Nihoa. Also recorded from French Frigate Shoal, Necker Is., Pearl and Hermes Reef, Kure Is., Midway and Johnston islands.

Lopes (*loc. cit.* and 1958:20) said that *bryani* differs from *formosensis* Townsend and *boninensis* Lopes by the shape of the head and male genitalia (cf. figs. 163b-d) with Lopes (1938:195, figures 1a-d and 1958:19, figures 1a-d). The front of *bryani* slopes obliquely with the antennae comparatively short and the head of *formosensis* is nearly quadrate with the antennae very long. The fifth sternum of the male is deeply cleft in *formosensis* and gently so in *bryani* (fig. 163b).

Rather small, mostly gray pollinose flies. With indistinct markings of black on mesonotum and abdomen. Fitting *Amobia* (Miltogramminae) characteristics by having the arista bare and the third and fourth sterna covered by the terga. Readily differentiated by the shape of the head (fig. 163c) and differ-

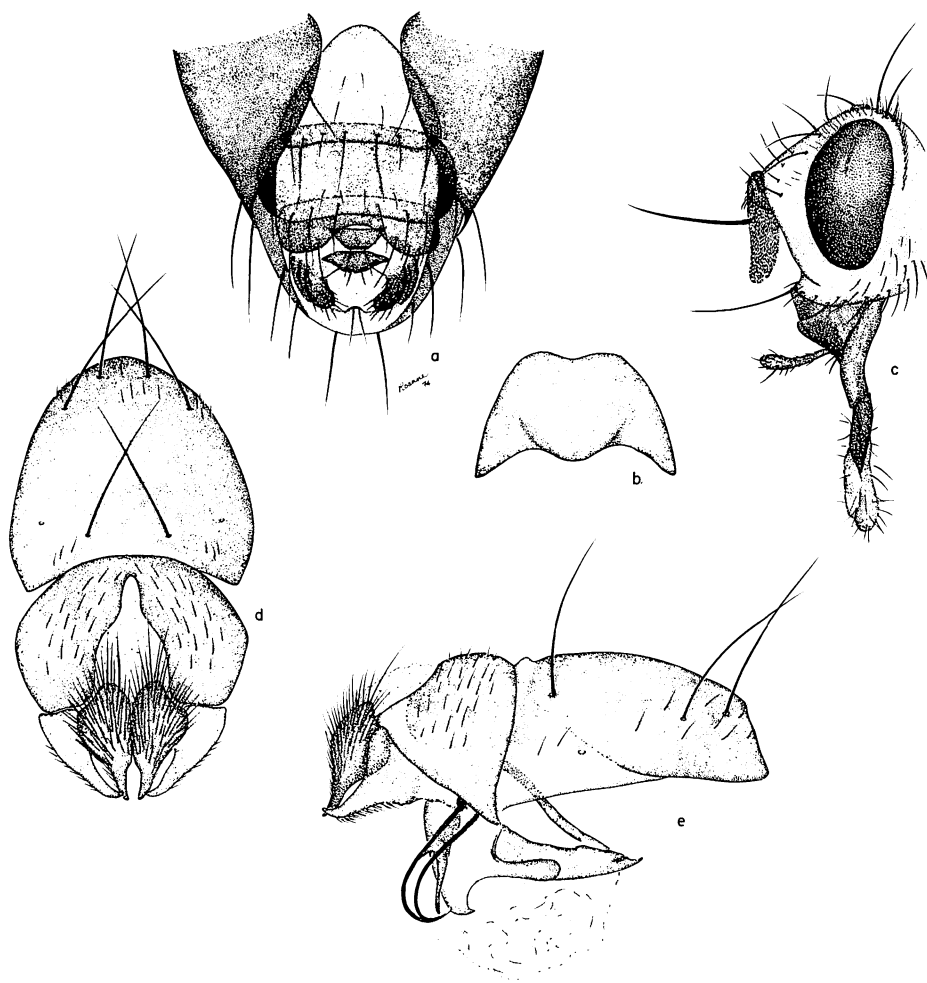


Figure 163—*Goniophyto bryani* Lopes: a, female abdomen, ventral; b, fifth sternum of male; c, head, lateral; d, male postabdomen, dorsal; e, male genitalia, lateral.

ences in vestiture of head, as well as thorax; presence of a strong costal bristle; and by the development of the postabdomen and genitalia of the male (figs. 163b,d,e).

The frons is about one-third head width in the female, just slightly narrower in the male. Two pairs of strong fronto-orbital bristles are present in the females. Lopes (*loc. cit.*) says these are present in the males, "about as long as ocellars (in some specimens very minute)." In the males I have examined only the upper reclinate fronto-orbital is distinctly present, the proclinales cannot be differentiated from the setae on the parafrontalia. Shape of head as in figure 163c. Vein R_1 bare, $R_4 + 5$ with 4-6 setae extending about $3/4$ the distance to r-m crossvein. Male fifth sternum and genitalia as in figures 163b,e, and female genitalia as in figure 163a.

Length: body, 4.5-7.0 mm.

For a more detailed description refer to the original.

Subfamily SARCOPHAGINAE

The members of this subfamily are characterized by having the arista plumose. Mesonotum gray with three black longitudinal vittae. Eyes bare. Front of female always broader than that of male. Face without carina.

Hind coxa with fine hairs on posterobasal portion. Abdominal terga usually gray with checkered pattern and sterna exposed, not covered by sides of terga. Fifth sternum of male with a deep V- or U-shaped cleft on hind margin (figs. 169d, 167a, 168d, and 170d). Male genital portion of abdomen consisting of two segments, terga 6-8 apparently fused. Female lacking ovipositor, with sixth tergum large and the sixth sternum well developed, also the seventh tergum usually poorly developed and the eighth vestigial or absent.

The Hawaiian species are arranged in four tribes.

Tribe RAVINIINI

According to Roback (1954:49) this tribe (as a subtribe) is differentiated by having the "juxta absent, except *R. effrenata* (Walk.); phallus and phallophore fused; corpus partially or entirely closed over ventrally; dorsal rods present in *Ravinia* and *Oxysarcodexia*; 3-5 posterior dorsocentrals; anterior acrostichals generally present; apical scutellars generally absent." Lopes (1969:21) said most of the genera in this tribe "are characterized by the fusion of theca and paraphallus (without articulation) and by the presence of a pair of plates representing females tergite VIII."

Two genera fit here.

Genus CHAETORAVINIA Townsend

Chaetoravinia Townsend, 1917, Proc. Biol. Soc. Wash. 30:193. Type-species, *Helicobia quadrisetosa*, Coquillett, by original designation, = *derelecta* (Walker).

This was placed as a subgenus of *Ravinia* by Downes (*in* Stone et al., 1965:954) and as a synonym of *Ravinia* by Roback (1954:73). I am following Lopes (1961a:422) in treating it as a genus.

Members of this genus are characterized by having vein R_1 setose and the epaulet yellow to brown, not black.

This is a new world genus, one species occurs in Hawaii. For a key to North American species refer to Dodge (1956:186).

***Chaetoravinia anandra* (Dodge) (figs. 164a-d)**

Chaetoravinia anandra Dodge, 1956, Ann. Ent. Soc. Amer. 49(2):187, fig. 15.

Type-locality: Kennesaw Mt., Georgia.

Maui, Molokai. First recorded in Hawaii by Lopes (1961a) from specimens collected June-July, 1953.

Immigrant. Widespread over eastern United States.

Bionomics. This species is evidently parthenogenetic, males have never been collected. It is apparently coprophagous.

According to Lopes (1961a:422), this is a very characteristic species "because of the shape of the genital sternites of female, especially of the last which is trapezoidal, bearing internally, near the lateral margins an elongate bar with hairs (figs. 1 A-D)."

A small species resembling *Helicobia morionella* (Aldrich) because of its small size and setose vein R_1 . It is differentiated by having four pairs of postsutural dorsocentral bristles, not three; by having three pairs of presutural acrostichals, rather than none; three rows of black postocular setae, rather than two; six pairs of bristles in frontal row, with upper pair about opposite upper reclinate bristles and lower pair opposite middle of second antennal segments, not with five pairs of bristles, lacking upper pair and with lower pair arising about opposite base of second segment; epaulets yellow to brownish, not black. Also the characteristics of the female abdomen are completely different in the two (refer to figures 164a-d and 168c). Sterna 6 to 8 are transverse oval, with the seventh being the largest and the last sternum trapezoidal (fig. 164b) and bearing an elongate setose appendage on each inner lateral margin (fig. 164d).

Length: body, 4.0-6.7 mm.

Genus **RAVINIA** Robineau-Desvoidy

Ravinia Robineau-Desvoidy, 1863, Hist. nat. des Dipt. des environs de Paris 2:434. Type-species, *Sarcophaga haematodes* Meigen, by original designation, = *permix* (Harris).

For synonymy refer to Downes, *in* Stone et al. (1965:953).

Fitting the grouping which has vein R_1 and the propleura bare. Differentiated by having the frontal rows of bristles parallel; presutural acrostichal bristles well developed; third antennal segment reaching to a line drawn from

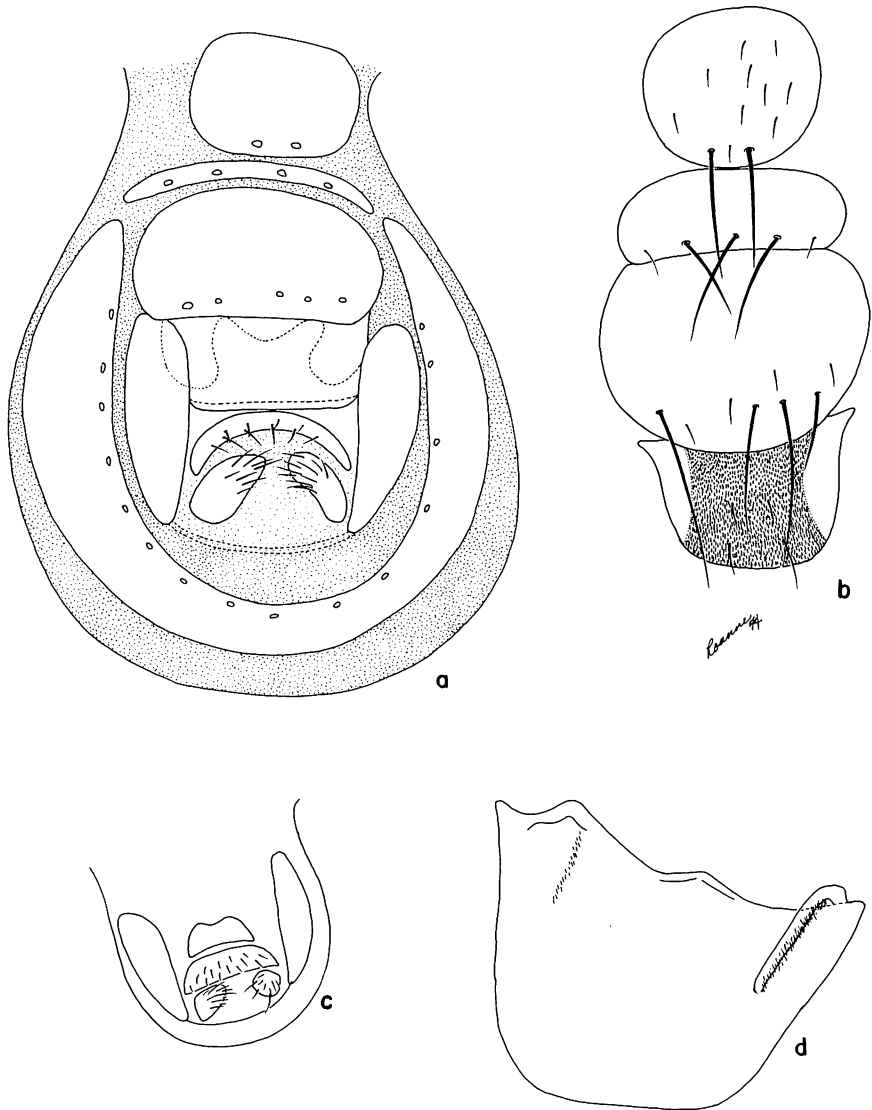


Figure 164—*Chaetoravinia anandra* (Dodge): a, female abdomen, ventral; b, genital sterna of female; c, eighth tergum and anal segment of female; d, last genital sternum of male (drawings copied from Lopes 1961:423).

lower margin of eye; mid femur of male with a row of short, broad posteroventral bristles on apical portion and male epandrium red, larger than first genital segment (6th + 7th tergum); aedeagus and genitalia as in figures 165a,f. Eighth tergum of female composed of two lateral plates (fig. 165g).

Bionomics. Members of this genus are coprophagous.

Subgenus **RAVINIA** Robineau-Desvoidy**Ravinia iherminieri** (Robineau-Desvoidy) (figs. 165a-g)

Myophora iherminieri Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. [ser. 2] 2:339.

Sarcophaga pallinervis Thomson, 1869, K. svenska fregatten Eugénies resa, Zool. Dipt.:535. Type-locality: Honolulu, Hawaii.

For other synonymy refer to Lopes (1961:422).

Common over the Hawaiian Islands from sea level to 7,000 ft.

Immigrant. North America.

It should be noted that Lopes places *Sarcophaga acerba* Walker and *querula* Walker as synonyms of *iherminieri*, following Aldrich (1930:13). Dodge (1956:188) resurrected these from synonymy, pointing out that *acerba* has only three pairs of posterior dorsocentrals, not four and differentiated *querula* by the following characters:

“Scutellum with one pair of large subapical marginal bristles and a second pair, less than half as long, and sometimes vestigial; female sternite 7 subtriangular, its sides tapering posteriorly; male second genital segment less than 0.8 of length of head at antennal axis *iherminieri* complex
Scutellum with two or three pairs of subapical marginals, the second pair at least half as long as the hindmost pair and often nearly as long; female sternite 7 large, subrectangular, its sides slightly convex and not converging posteriorly; male second genital segment more than 0.8 the length of head *querula*”

Dodge (*loc. cit.*) indicates that on the basis of larval characters a complex may be represented in the concept of *iherminieri* as he has restricted it. “Two larval forms are easily recognized from the pupal exuviae pinned with reared flies. The first form is figured by Greene (1925, pl. 1, fig. 3) [as *communis* Parker] from Texas and also has been received by me from Hawaii. The second form, very similar to that figured by Greene (above) for *ochracea* Aldrich [Pl. I, fig. 2, as *communis* var. *ochracea*], has been seen from Black Forest, Colorado.”

Bionomics. According to James (1948:48), “this species has been recorded from three cases of supposed intestinal myiasis in Texas. It breeds in excrement, including that of man and the above mentioned records were probably based on material received from subsequently contaminated stools.”

A moderate-sized species differentiated from other Hawaiian sarcophagids

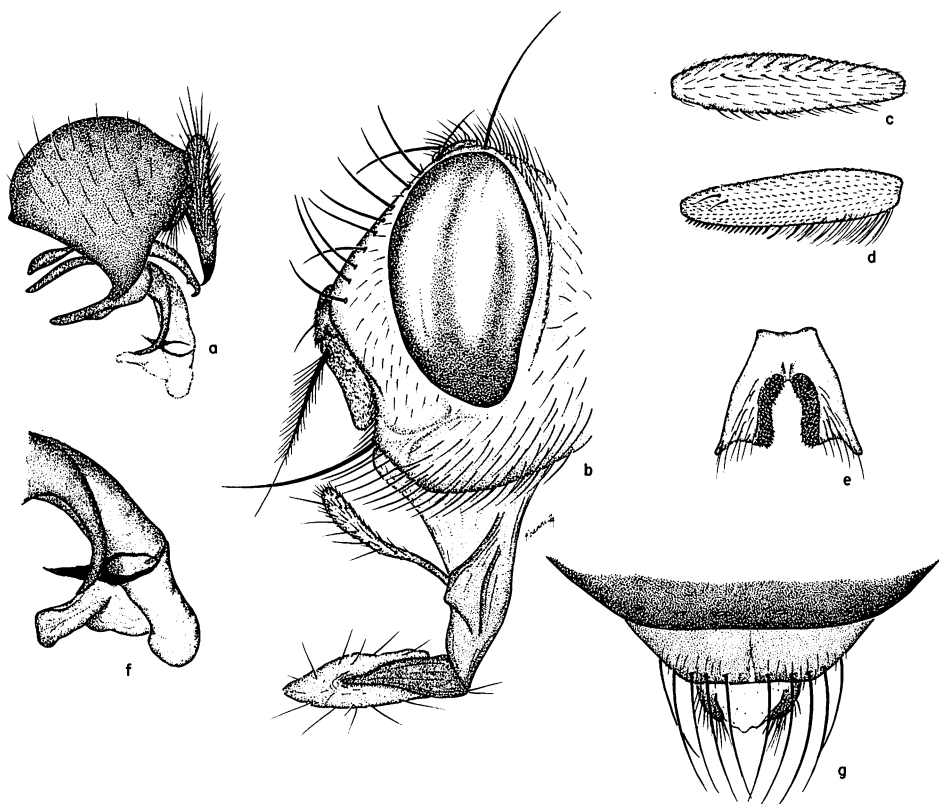


Figure 165—*Ravinia iherminieri* (Robineau-Desvoidy): a, male genitalia, lateral; b, head of male, lateral; c, hind femur of male, anterior; d, mid femur of male, posterior; e, fifth sternum of male; f, apical portion of male aedeagus; g, apex of female abdomen, dorsal.

by the generic characters given above. In addition, the head is about 4.5 times wider than narrowest portion of the front in the male and about 3 times wider in female. The row of frontal bristles contains about nine strong bristles in both sexes (fig. 165b). The parafacials broad, nearly half the longitudinal width of the eye and bearing several incomplete rows of somewhat scattered small black setae. Genae broad, nearly three-fifths the eye height and black setose, except for some white hair on back margin. Three rows of black postocular setae. Four pairs presutural acrostichals. Three pairs presutural and four pairs postsutural dorsocentrals. Both epaulet and basicostal scale yellow. Mid femur with a row of short anteroventral and a row of posteroventrals over about apical three-fourths of segment; the latter row has longer bristles in median portion and short, thick, comb-like bristles on apical two-fifths (fig. 165d). Hind femur with two incomplete rows of anterior ventral bristles over most of its length (fig. 165c) and a few scattered posteroventrals near base. Fifth sternum of male as in figure 165e. Male genitalia red, shaped

as in figure 165a. The aedeagus with the theca very long and fused with the paraphallus and with the ventralia (preapical ventral lobes) large and paired (fig. 165f). Female genital segments red, the eighth tergum represented by a pair of lateral plates (fig. 165g).

Length: body, 7.0–10.0 mm.; average 9.0 mm. for males and 8.25 for females.

Tribe SARCOPHAGINI

According to Roback (1954:49), members of this tribe (as a subtribe) are differentiated by male aedeagus with the “median process fused to juxta; division of ventral sclerotization takes place before modification; capitis, harpes, small sclerous lateral plates, and a rudimentary phallic tube may be present; 2 to 6 posterior dorsocentrals.” The males have no proclinate fronto-orbital bristles and the theca of the aedeagus is well developed.

Seven Hawaiian genera and three subgenera fit here.

Genus **BERCAEA** Robineau-Desvoidy

Bercaea Robineau-Desvoidy, 1863, Hist. nat. Dipt. des environs de Paris 2:549. Type-species, *Musca haemorrhoidalis* Fallén.

For synonymy refer to Kano et al. (1967:9).

Roback (1954:66) treats this as a synonym of *Sarcophaga* Meigen.

Rohdendorf (1965:401) treated this in his tribe Sarcophagini, subtribe VI, Parasarcophagina, and characterized the genus as having no acrostichal bristles; “anal tergite bright red; phallosome very large, several times the length of the theca; membranous lobes forming a single pair of very large, sharp, markedly forward-protruding processes; apical part of paraphallus small, but clearly demarcated and extending forward; 6th tergite of female abdomen [6 + 7] completely divided into two convex plates, bright red, abdomen nitid.”

Bercaea haemorrhoidalis (Fallén) (figs. 166a–d)

Musca haemorrhoidalis Fallén, 1817, K. Vetensk. Acad. Handl. [ser. 3], 1816:237.

For synonymy refer to Lopes (1961a:425) and Lopes et al. in Delfinado and Hardy (1977:564).

Downes, in Stone et al. (1965:958) treats this under *Sarcophaga*.

Oahu, Kauai, Lanai, Molokai, Hawaii, very probably on all the main islands.

First reported in Hawaii in April 1917 by Timberlake (1918:371) and Swezey (1918:379).

Immigrant. Nearly cosmopolitan.

Bionomics. A scavenger, strongly attracted to excrement. In Hawaii it breeds commonly in dog feces. It also breeds in carrion and on a few occasions

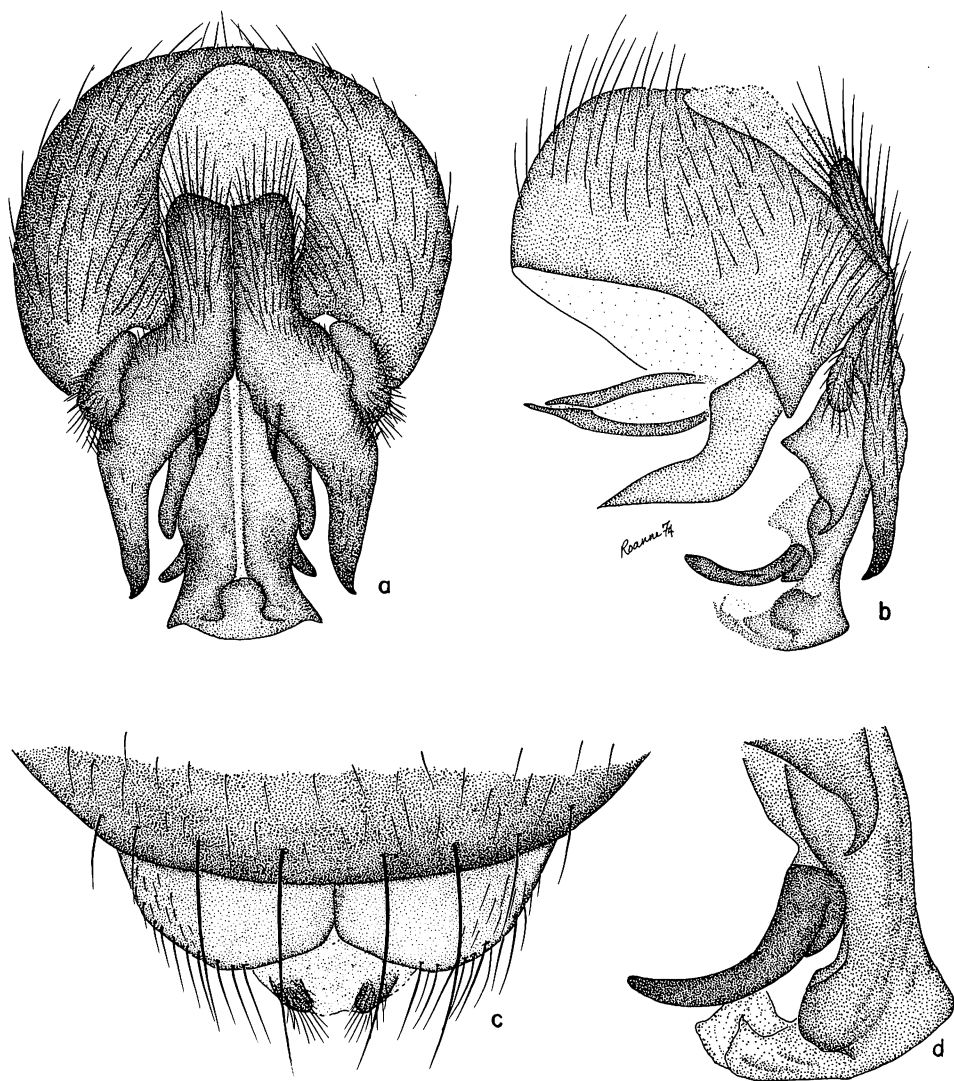


Figure 166—*Bercaea haemorrhoidalis* (Fallén): a, male genitalia, end view; b, male genitalia, lateral; c, apex of female abdomen, dorsal; d, male aedeagus, apical portion.

has been reported (in other parts of the world) as a parasite of other insects such as Lepidoptera and Orthoptera (Hinds and Dew 1915, Regnier 1931, and Webster 1907) and it has been incriminated in some cases of wound and intestinal myiasis in humans (James 1948:50 and Judd 1956). The latter records are highly questionable (refer to Zumpt 1965:104).

The biology, as well as the figures of the immature stages, are discussed by Zumpt (*loc. cit.*).

Fitting in the grouping of species (genera) characterized by having vein R_1 and the propleura bare; antennae and at least apical portions of palpi black or dark colored, densely gray pollinose; frontal rows of bristles extending below bases of antennae and divergent; only two well-developed, postsutural dorsocentrals, situated close to scutellum and epandrium of male and genital segments of female rufous. It fits near *Parasarcophaga* (*Thomsonea*) *argyrostoma* (Robineau-Desvoidy) and is differentiated by having black setae on the anterior portion of each gena; the theca of the male aedeagus short, much reduced (figs. 166b,d); lobes of male cerci ("superior forceps") long, narrowly pointed, and widely divergent, as seen from end view (fig. 166a); the female tergum 6 + 7 with a deep excision in middle of hind margin (fig. 166c).

Middle femur of male with numerous long hairs on basal half of posteroventral surface and hind femur with abundant ventral hairs. Hind tibia with numerous long anteroventral and posteroventral hairs. For more detailed description refer to Kano et al. (1967:9).

Length: body, 8.5–15.0 mm.

Genus **BOETTCHERISCA** Rohdendorf

Boettcherisca Rohdendorf, 1937, Fauna U.S.S.R. (N. S.) Dipt. 19(1):270, 458.

Type-species, *Myophora peregrina* Robineau-Desvoidy, by original designation.

Athyrsiola Baranov, 1938, Vet. Arch. Zagreb. 8(4):174. Type-species, *atypica* Baranov, by original designation.

Lopes (1961b:70) characterized this genus as follows: "Propleura hairy on the center. Four or more postsutural dorsocentral bristles, only two posterior strong ones. R_1 bare. First genital segment of the male without marginal series of bristles. Phallosome well constituted. Ventralia of penis well developed, bilobed, bearing numerous spines. The lateral plates of the paraphallus are elongated plates with two sharp points on the extremity. Glans short and robust, not surpassing the apical plate of paraphallus. First genital tergite of females entire or interrupted at the middle, always with parallel posterior margins. Tergite 8 represented by a strong chitinized trapezoidal plate. Sternite 8 strongly concave on posterior margin with long bristles on lateral posterior side."

This is treated as a synonym of *Sarcophaga* Meigen by Roback (1954:67).

Boettcherisca peregrina (Robineau-Desvoidy) (figs. 167a–c)

Myophora peregrina Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. [ser. 2] 2:356.

Sarcophaga fuscicauda Boettcher, 1912, Ent. Mitt. 1(6):169.

For other synonymy refer to Lopes (1958:29 and 1961a:422).

Widespread throughout the islands, especially in the lowlands. First collected in Hawaii in 1905 (Timberlake 1920:256) and first recorded by

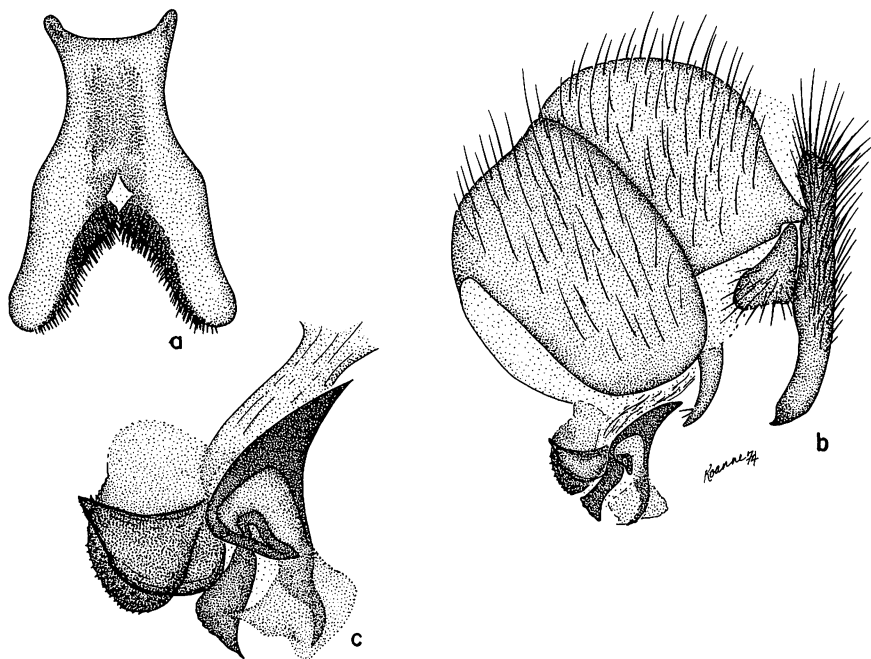


Figure 167—*Boettcherisca peregrina* (Robineau-Desvoidy): a, fifth sternum of male; b, male genitalia, lateral; c, apex of male aedeagus.

Timberlake (1918) as *Sarcophaga* sp. and later as *S. fuscicauda* Boettcher (Illingworth 1926). The synonymy with *peregrina* was pointed out by Lopes (1941:55).

Immigrant. Spread widely over the Oriental Region, much of the Pacific including the Bonin, Volcano and southern Mariana islands, Samoa, New Guinea, and Australia; also Japan and South China.

Bionomics. Illingworth (1923b:270) reported it as the most abundant fly breeding in chicken manure and said it is common around human habitations "breeding upon any available food or excrement." He said (1926) that in Australia it was a particularly troublesome species and evidently favors human excrement for breeding. He reared a cynipid wasp, *Eucoila impatiens* Say from the pupae. James (1948:55) says this species has been known to larviposit in wounds "and it is said to be almost as closely associated with man in certain tropical regions as the housefly (*Musca domestica* L.)" Zumpt (1965:108) reported two cases of traumatic myiasis in humans apparently involving *peregrina*.

Differentiated from other sarcophagids in Hawaii by having vein R_1 bare, the propleura setose in middle and the preapical ventral vesicae on aedeagus large, and conspicuously spiculose (figs. 167b,c). Fifth sternum as in figure 167a.

For a detailed description refer to Lopes (1958:29 and 1961b:71).

Length: body, 7.0–12.0 mm.

Genus **HELICOBIA** Coquillett

Helicobia Coquillett, 1895, Proc. Acad. Nat. Sci. Phila. 1895:317. Type-species, *Sarcophaga helici* Townsend, by original designation, = *rapax* (Walker).

For synonymy refer to Roback (1954:63).

Readily differentiated from other sarcophagids in Hawaii which have both veins R_1 and $R_4 + 5$ setose, by having only three pairs of dorsocentral bristles, and by having tergum 6 + 7 in female composed of two laterally opposed plates (fig. 168c).

Downes, in Stone et al. (1965:949) says "the Nearctic species of this genus are scavengers or perhaps occasionally parasitic in insects and snails."

For a review of the genus refer to Lopes (1939).

Helicobia morionella (Aldrich) (figs. 168a–d)

Sarcophaga morionella Aldrich, 1930, Proc. U. S. Nat. Mus. 78(12):31.

Sarcophaga surrubea Aldrich, 1916, *Sarcophaga and allies*, La Fayette, Indiana, p. 154; not van der Wulp (1895).

Common on all the main Hawaiian islands. First reported from Honolulu, April 1936 by Williams (1937) as *Helicobia helici* Townsend; corrected to *morionella* by Hardy (1952b:477).

Immigrant. Southern portion of United States, California to North Carolina, Mexico and West Indies; also on Wake Island.

Bionomics. Breeds as a scavenger on dead snails and may evidently also be parasitic on lawn army worm *Spodoptera mauritia acronyctoides* (Guenée) according to Bianchi (1964); Lopes (1961a:421) reported a specimen bred from a pupa of *Spodoptera mauritia* on Oahu.

Because of its small size this superficially resembles *Sarcophagula occidua* (Fabricius) and *Chaetoravinia anandra* (Dodge). It fits closest to the latter and is differentiated by having three pairs of postsutural dorsocentrals as well as other characters (refer to the discussion under *anandra*).

Frons of both sexes about equal in width, females one-third the width of head and male slightly less. Frontal row of bristles only slightly diverging, below made up of seven strong bristles in male, counting the upper reclinate fronto-orbital, which is almost in line with the other bristles, and only four or five bristles in the row in females. The latter with two strong proclinate and one reclinate fronto-orbitals (fig. 168b). The proclinate bristles are lacking in the males. Two rows of black postocular setae present, occiput otherwise with rather scattered yellow-white setae. Thorax gray with three brown to black vittae. Two presutural and three postsutural dorsocentrals and only prescutellar acrostichals present. Scutellum with four bristles. Legs lacking villosity. Ab-

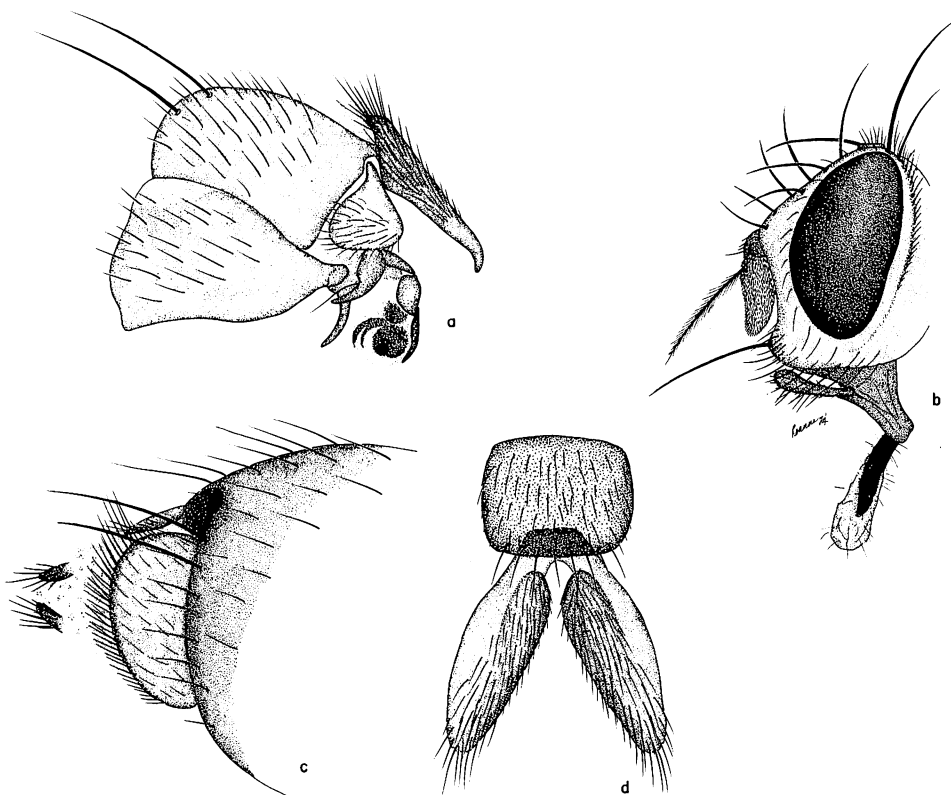


Figure 168—*Helicobia morionella* (Aldrich): a, male genitalia, lateral; b, head of female, lateral; c, apex of female abdomen, lateral, slightly tilted to show top edges of fifth and sixth terga; d, fifth sternum of male.

domen black and silvery with changeable tesellation. Male genitalia usually red but often mostly or entirely black. Fifth sternum deeply V-shaped on hind margin (fig. 168d) and genitalia as in figure 168a. In the female, the posterior edge of the fifth tergum (seen in end view) forms a black vertical wall above the genitalia. Terga 6 and 7 are fused and divided into a pair of large, laterally opposed plates (fig. 168c) which enclose the ovipositor in resting position.

Length: 3.5–6.25 mm.

For more descriptive details refer to Lopes (1939:506).

Genus **HYSTRICOCNEMA** Townsend

Hystricocnema Townsend, 1919, *Insecutor Inscitiae Menstruus* (1918) 6:160.

Type-species, *Sarcophaga robusta* Aldrich, by original designation, = *plinthopyga* (Wiedemann).

Downes (1965:945) treated this as a synonym of *Kellymyia* Townsend under the combination *Blaesoxipha* (*Kellymyia*). Lopes (*in litt.*) does not agree with this and says that *Hystricocnema* and *Kellymyia* are quite distinct genera.

The male genitalia are completely different from those of *Blaesoxipha*, the lobes of the cerci are straight and not bent upward and the aedeagus, other details of the genitalia (fig. 169a), and the fifth sternum (fig. 169d) are very different in development.

The genus is differentiated by having numerous ventral, short, robust bristles; genital segments red in both sexes and genital sterna of females very broad; cerci of male sinuous; venter of abdomen lacking long pile; 4-5 postdorsocentral bristles; propleura bare; vein R_1 bare and arista plumose.

Roback (1954:49) placed this in a subtribe Hystricocnemina characterized by male aedeagus with a "large median process and spinose lateral filaments formed; fifth sternite without window; very wide and shallow; anal forceps, in lateral view, bipronged vertically; anal forceps as wide or wider than high; 5 posterior dorsocentrals."

One genus and species fits here.

Hystricocnema plinthopyga (Wiedemann) (figs. 169a-e)

Sarcophaga plinthopyga Wiedemann, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. [ser. 2] 2:360.

Sarcophaga robusta Aldrich, 1916, *Sarcophaga and allies in North America* [vol. I]:268.

Widespread over the islands. First recorded (as *Sarcophaga robusta*) by Illingworth (1918a) in May 1917. It has been treated in the Hawaiian literature as *S. robusta*, *S. plinthopyga* (Wiedemann) and under the generic name *Hystricocnema* Townsend.

Immigrant. Western and southern United States, Mexico, West Indies, and Virgin Islands.

Bionomics. Breeds principally in carrion. James (1948:51) says that "the larvae differ in their feeding habits and are commonly found on carcasses or as parasites in the bodies of insects. However, they frequently attack old and festered sores in man and animals or invade diseased body openings. According to Patton this is a notorious myiasis-producing species in British Guinea. In Texas it has been reported as infesting rabbits and other animals and causing serious damage to tissues."

For list of organisms which have been associated with *plinthopyga* refer to Greenberg (1971:451-452).

This species is differentiated from others in Hawaii which have vein R_1 and the propleura bare by having strong ventral spines on hind femora of male (fig. 169b). Also by the first genital segment of the male (tergum 6 + 7) being large, robust, extending $1/2$ to nearly two times longer than the fifth tergum and red in color at least apically. The male genitalia are characteristic as in figure 169a. The females are differentiated by having the sixth sternum very large, almost as large as the tergum, and the hind margin undulated (fig. 169e); the female genital segments are red.

Head silvery pollinose except for the compound eyes. Two rows of black postorbital setae and with genae mostly black setose except for dense white

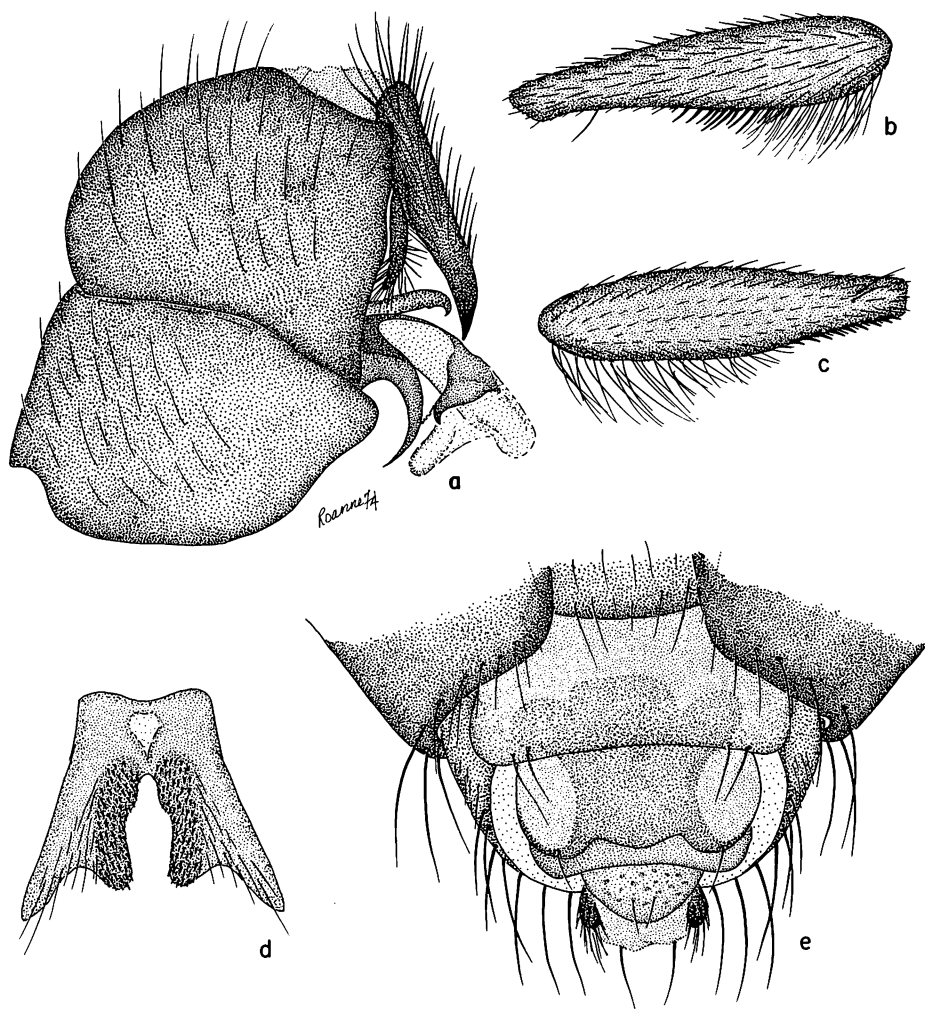


Figure 169—*Hystricocnema plinthopyga* (Wiedemann): a, male genitalia, lateral; b, hind femur of male, lateral; c, mid femur of male, lateral; d, fifth sternum of male, ventral; e, female abdomen, ventral.

hairs on hind portion continuous with the white pilosity over occiput. Frontal row slightly divergent in last two bristles. Antennae black, palpi usually so, sometimes tinged with rufous. Mesonotum with four pairs of small presutural and two pairs prescutellar acrostichal bristles. Four pairs moderately small presutural dorsocentrals, and two to three pairs small, and two pairs moderate postsutural dorsocentrals. Metapleuron with four marginal bristles plus several to many scattered hairs. Mid femur of male with a row of short, spine-like, anteroventral bristles on about basal half and a row of posteroventrals on apical two-fifths, and ventral surface rather densely long-haired over basal half

to three-fifths (fig. 169c). Hind femur with numerous spine-like, ventral bristles over median portion (fig. 169b). Fifth sternum of male as in figure 169d and genitalia as in figure 169a. The lobes of the cerci (anal forceps) are straight, tapered to sharp points at apices. The anterior parameres are strongly curved and the posterior parameres are blunt at apices and have two small, preapical, ventral teeth. The ventralia (vesica) of the aedeagus is large, lobate (fig. 169a).

Genus **PARASARCOPHAGA** Johnson and Tiegs

Parasarcophaga Johnson and Tiegs, 1921, Proc. R. Soc. Queensland 33(4):86.

Type-species, *Sarcophaga omega* Johnson and Tiegs, by monotypy, = *Sarcophaga knabi* Parker.

Kano et al. (1967:38) characterizes the genus as having "apical part of paraphallus well distinguishable; ventralia present; paraphallus short; styli curved; postsutural dorsocentral bristles four or five and two posterior ones strong; first and second abdominal sternites with long dense pile, third and fourth with short sparse hairs; body length usually great."

This is treated as a synonym of *Sarcophaga* Meigen by Roback (1954:66).

Subgenus **PARASARCOPHAGA**

According to Lopes (1958:36) this subgenus is characterized by the male aedeagus having a long stalked ventralia; first genital tergum (6 + 7) of female (Lopes says 7 is vestigial) divided into two well-separated plates; seventh sternum of female bare or with a transverse row of strong bristles; eighth sternum membranous; anal membrane bearing delicate hairs which have large pigmented bases.

Parasarcophaga (Parasarcophago) albiceps (Meigen) (figs. 170a-e)

Sarcophaga albiceps Meigen, 1826, System. Besch. der bekannt. Europ. zweifl. Insekt. 5:22.

For synonymy refer to Kano et al. (1967:39); the record of *S. knabi* from Hawaii, by Tanada et al. (1950:31) is an error for *albiceps*.

Oahu, Maui. Very probably on other islands. First recorded from Honolulu by Lopes (1941:56).

Immigrant. Widespread over Oriental and Palaearctic regions and also New Guinea, New Britain, and Solomon Islands.

Bionomics. Breeds in all kinds of rotting organic matter including carrion and feces. James (1948:56) says it has been recorded causing traumatic myiasis in a bull.

This species fits closest to *Parasarcophaga (Liosarcophaga) misera* (Walker) and is differentiated by having two irregular rows of black setae besides the regular row of postocular setae, rather than with only the postocular row black; aedeagus of male with the ventralia widely expanded, pedunculate (fig. 170b),

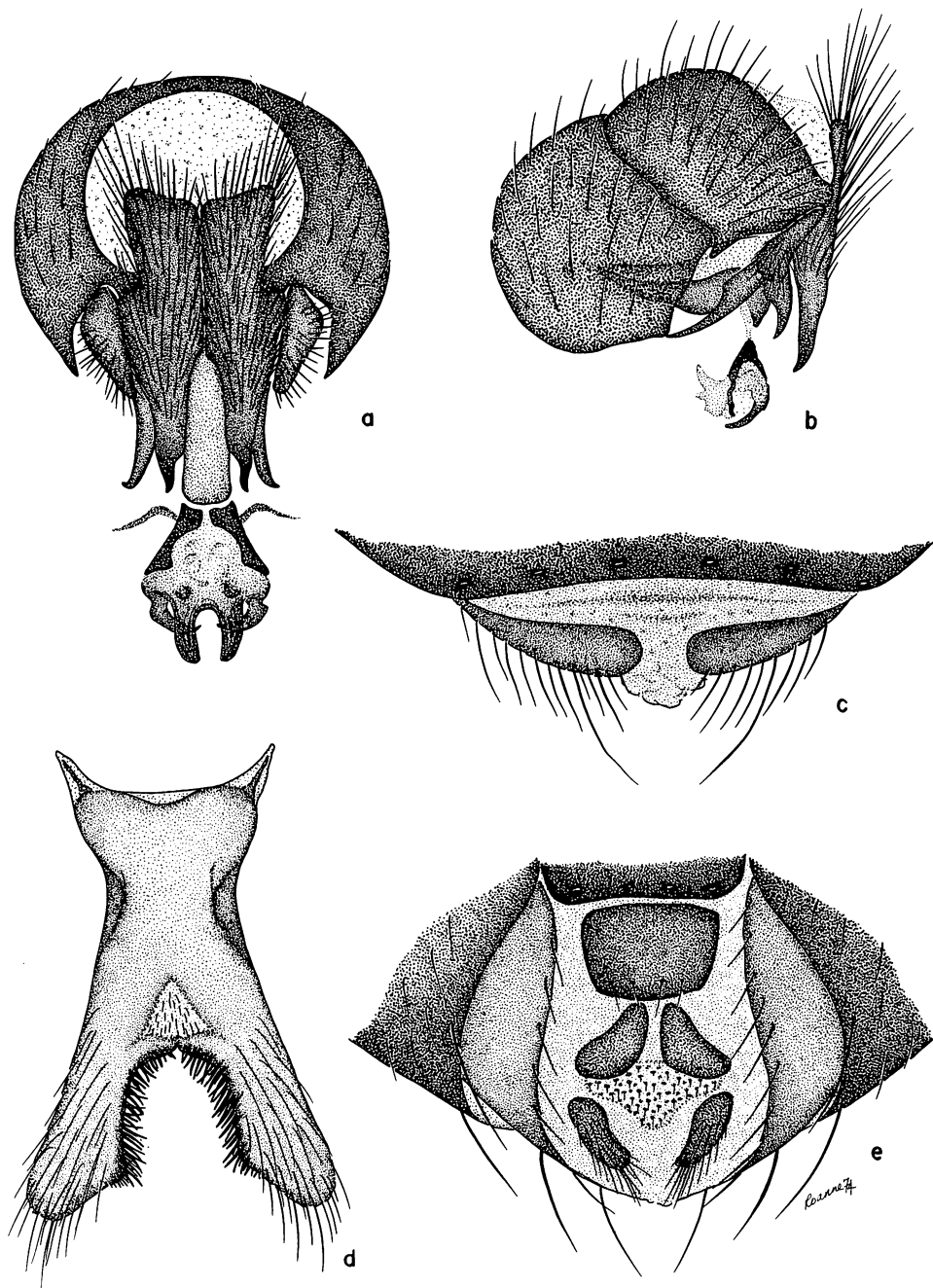


Figure 170—*Parasarcophaga* (*Parasarcophaga*) *albiceps* (Meigen): a, male genitalia, end view; b, male genitalia, lateral; c, apex of female abdomen, dorsal; d, fifth sternum of male, ventral; e, apex of female abdomen, ventral.

and the lobes of the cerci each with a notch-like depression before apex on inner side (fig. 170a). The lobes of the fifth sternum of male are separated by a broadly U-shaped cleft and are less densely setose on inner margins (fig. 170d) than in *misera*. In the latter the cleft between the lobes is V-shaped and the inner margins are very densely covered with short, broad, almost scale-like setae (fig. 172b). Tergum 6 + 7 in female divided into two parts by a membranous area down middle (fig. 170c). Eighth sternum straight on hind margin (fig. 170e).

In addition to the above, the prosternum is setose. Only the prescutellar acrostichals are developed. The mid and hind femora and the hind tibiae have long ventral villosity, it is especially long and curled on the posteroventral surfaces.

For a more detailed description refer to Kano et al. (1967:39).

Length: body, 9.0–15.0 mm.

Subgenus **LIOPYGIA** Enderlein

Liopygia Enderlein, 1928, Arch. Klass. phyl. Ent. Wien 1(1):41. Type-species, *Musca ruficornis* Fabricius, by original designation.

Lopes (1958:18) placed this in the subgenus *Jantia* Rohdendorf and differentiated it from *Thomsonia* Rohdendorf by having the ventralia of the male aedeagus rudimentary, rather than well developed. Lopes et al. in Delfinado and Hardy (1977:568) has now placed *ruficornis* (Fabricius) in the subgenus *Liopygia* Enderlein.

Parasarcophaga (Liopygia) ruficornis (Fabricius) (figs. 171a–c)

Musca ruficornis Fabricius, 1794, Entomologia Systematica emend. et aucta. 4:314.

This was placed (provisionally) in the subgenus *Jantia* by Lopes (1958:48). It should be noted that *Liopygia* Enderlein (type-species *M. ruficornis* Fab.) is treated as a synonym of *Sarcophaga* by Roback (1954:67).

Oahu and Kauai. First reported by Joyce (1949:338), from Honolulu.

Immigrant. Spread over the Oriental Region, including the Ryukyu and Amami islands (south of Japan), Mariana Islands, Moluccas, Samoa; also east Africa and Madagascar.

Bionomics. General scavenger, breeding in an assortment of rotting organic materials including carrion and feces. It has been reported to commonly produce traumatic and cutaneous myiasis in man and other animals in India and Indochina but most of these records are questionable (refer to Zumpt 1965:107). James (1948:55) says "it has also been reported in intestinal myiasis." The latter record is most doubtful and no doubt resulted from subsequent contamination of stools.

This species is readily differentiated from other sarcophagids in Hawaii which have vein R_1 and propleura bare; by having the antennae and palpi

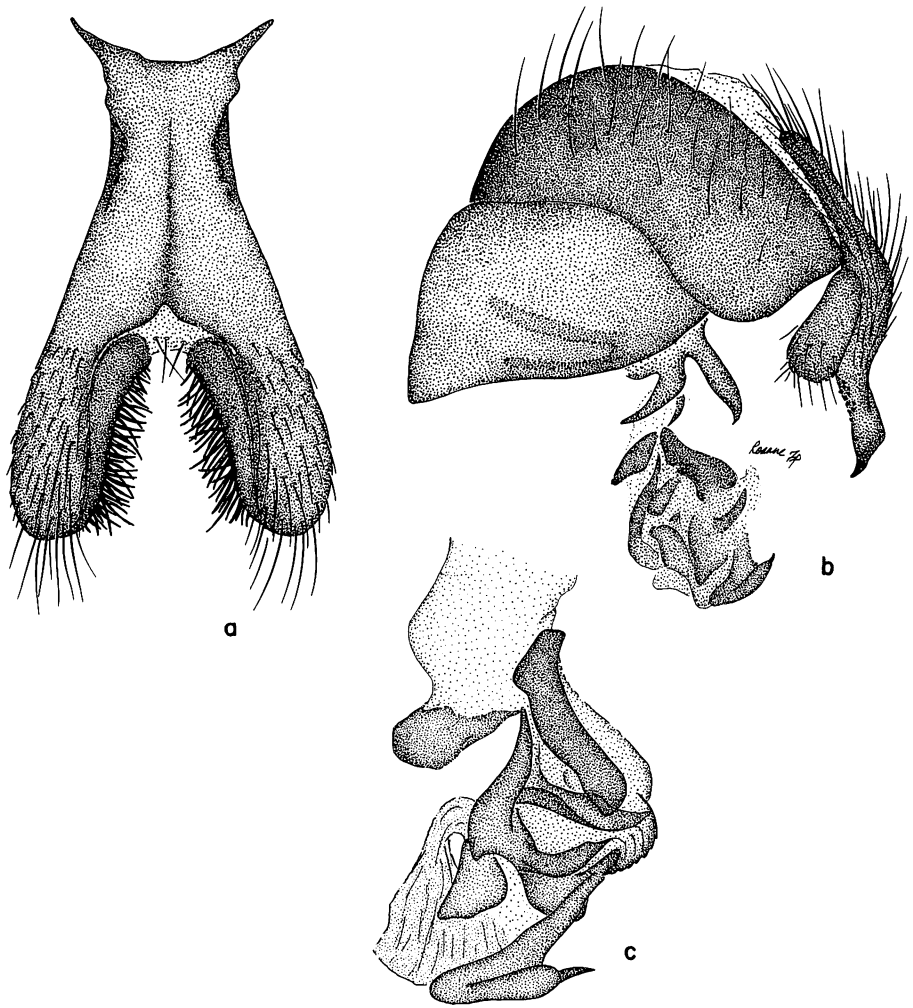


Figure 171—*Parasarcophaga (Liopygia) ruficornis* (Fabricius): a, fifth sternum of male, ventral; b, male genitalia, lateral; c, apical portion of aedeagus.

orange-red; the genae and occiput entirely white pilose except for the postocular row of black setae and by the distinctive genitalia of the male (figs. 171a-c).

The male head is 4.5 times wider than the front. Only the prescutellar acrostichals are developed. The prosternum is setose. Mid femora of male each with a row of posteroventral bristles extending almost entire length of segment, the bristles in the median portion are strong, about $\frac{3}{4}$ as long as basitarsus. The mid femora also with moderately long, curled hairs on basal half of posteroventral surface, this villosity is not so long and so dense as in *Parasar-*

cophaga albiceps (Meigen) and *misera* (Walker). The hind legs of the male have no long villosity on tibiae or femora. The postabdomen is rufous in both sexes. The male cerci are black and acutely pointed at apices and densely black haired over basal portion (fig. 171b). The apical plates of the aedeagus are distinctly separated, rather capitate with a spine-like process from upper hind margin of each lobe (fig. 171c). The fifth sternum of male is as in figure 171a.

For more complete descriptions refer to Lopes (1958:48) and to Kano et al. (1967:73).

Length: body, 8.0–15.0 mm.

Subgenus **LIOSARCOPHAGA** Enderlein

Liosarcophaga Enderlein, 1928, Arch. Klass. phyl. Ent. Wien 1:18. Type-species, *Cnomyia madeirensis* Schiner, by original designation.

According to Lopes (1958:18), this subgenus is characterized by having a long slender appendage on each side of apical plate of male paraphallus (fig. 172a). According to Rohdendorf (1937:422 and 1965:403), the ventralia are comprised of a single pair of lamellate processes and the ventral processes of the basal part of paraphallus are lamellate, similar to ventralia but more sclerotized.

Parasarcophaga (Liosarcophaga) misera (Walker) (figs. 172a–d)

Sarcophaga misera Walker, 1849, List. Dipt. Ins. Brit. Mus. 4:829.

Sarcophaga dux Thomson, 1869, K. svenska fregatten Eugenie's resa, Zool., Dipt. 2:534 (type-locality: Honolulu).

For other synonymy refer to Lopes (1961a:425).

Common throughout the islands. First recorded by Thomson as *Sarcophaga dux* in 1869. This has been in the Hawaiian literature under the species name *dux* until this was synonymized by Lopes (1958:41). It should be noted that Parker (1919:43) was in error recording *harpax* (Pandellé) (as a subspecies of *dux*) as occurring in Hawaii. The latter occurs over the Palaearctic and Nearctic regions.

Immigrant. Widespread over the Oriental Region and throughout much of the Pacific to Australia.

Bionomics. Breeds in wide assortment of rotting organic matter. According to James (1948:53), this is normally a carrion feeder but has been reported as causing myiasis in the ear, mastoid, intestine, and skin. He says it is a sheep maggot of secondary importance in Australia.

In Hawaii the pupae are parasitized by the pteromalid wasp, *Mormoniella brevicornis* Ashmead (Timberlake 1924:421), and by an encyrtid, *Exoristobia philippinensis* Ashmead (as *Pseudencyrtus* sp.) (Wilton 1962).

This species runs near *Parasarcophaga albiceps* (Meigen) and is differentiated by the differences in terminalia of both sexes. Also the back of the head has only a few black hairs above, in addition to the postocular row, rather than with

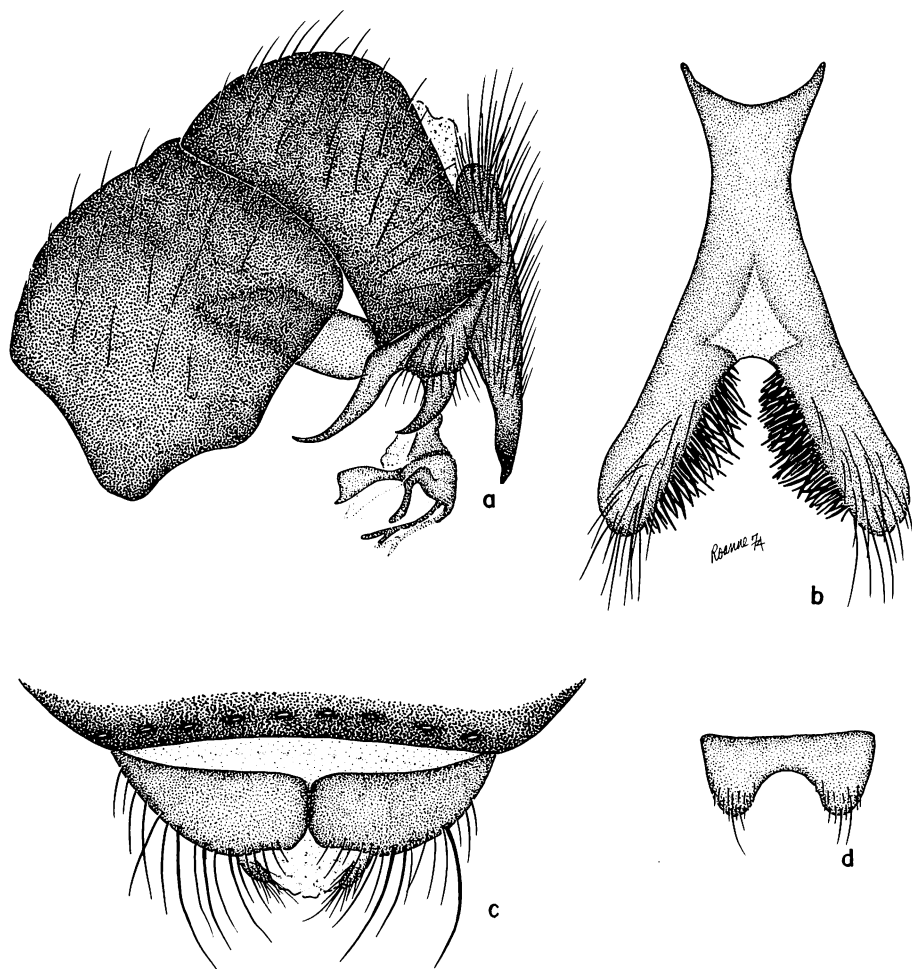


Figure 172—*Parasarcophaga (Liosarcophaga) misera* (Walker): a, male genitalia, lateral; b, fifth sternum of male; c, apex of female abdomen, dorsal; d, eighth sternum of female.

two irregular rows of black setae behind the postocular row. The characters of the male aedeagus are very distinctive, the ventralia is not pedunculate and the paraphallus has a pair of slender lobes near apex (fig. 172a). The fifth sternum of male is as in figure 172b. The lobes of the cerci are uniformly tapered to the apex (fig. 172a), not with a notch on inner margins. Hind margin of tergum 6 + 7 of female straight (fig. 172c) and hind margin of 8th sternum concave (fig. 172d).

Fitting most of the characters of *albiceps* except as noted above. Also, the hind femora of the males lack the elongate curled hairs on posteroventral surface.

For a more detailed description refer to Kano et al. (1967:48).
Length: body, 8.0–13.0 mm.

Subgenus **THOMSONEA** Rohdendorf

Thomsonea Rohdendorf, 1937, Faune U.S.S.R. (N.S.) Dipt. 19(1):247. Type-species, *Sarcophaga barbata* Thomson, by original designation, = *Myophora argyrostoma* Robineau-Desvoidy.

According to Lopes (1958:18), this subgenus fits near *Parasarcophaga* (*Jantia*) Rohdendorf by having the ventralia not pedunculate and no appendage on apical plate of paraphallus. It is differentiated by having the ventralia well developed (fig. 173c) rather than rudimentary. Rohdendorf (1965:402) gave the following characters for *Thomsonea*: "Posterior part of phallosome more or less sclerotized; apical part of paraphallus with a clearly separated median portion and a pair of lateral processes; membranous lobes large, lamellate, with a sharp apical tooth; ventral processes of basal part of paraphallus also large, with a terminal hook."

Parasarcophaga (Thomsonea) argyrostoma (Robineau-Desvoidy) (figs. 173a–f)

Myophora argyrostoma Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. [ser. 2] 2:340.

Sarcophaga barbata Thomson, 1869, K. svenska fregatten Eugénies resa, Zool., Dipt. 2:533 (type-locality: Honolulu).

For other synonymy refer to Lopes (1961:426) and Lopes et al. (*in* Delfinado and Hardy 1977:572).

This is treated under *Sarcophaga* Meigen by Downes (*in* Stone et al. 1965:957).

Common over the Hawaiian Islands. First recorded as *barbata* by Thomson (1869) and known in Hawaiian literature by this name until corrected by Hardy (1952b:478); temporarily placed under the combination *Probellieria argyrostoma*.

Immigrant. Cosmopolitan.

Bionomics. Breeds as a scavenger in rotting organic matter, common on carrion. James (1948:54) says it (as *Sarcophaga barbata* Thomson) has been reported as a parasite on several species of insects and "it is known to larviposit commonly in wounds of man and animals." He also says that "because of the large size and rapid development of the larvae, they can cause both extensive and deep lesions, sometimes penetrating to the bone or to a depth of 1 or 2 inches into the muscle. Because of the crippling action it is one of the most serious of the myiasis-producing *Sarcophaga*."

In Hawaii, it is parasitized by the pteromalid wasp *Mormoniella brevicornis* Ashmead (Timberlake 1924:421). For a study of the biology and immature stages of this species refer to Yates (1967). For a study of the ultrastructure of

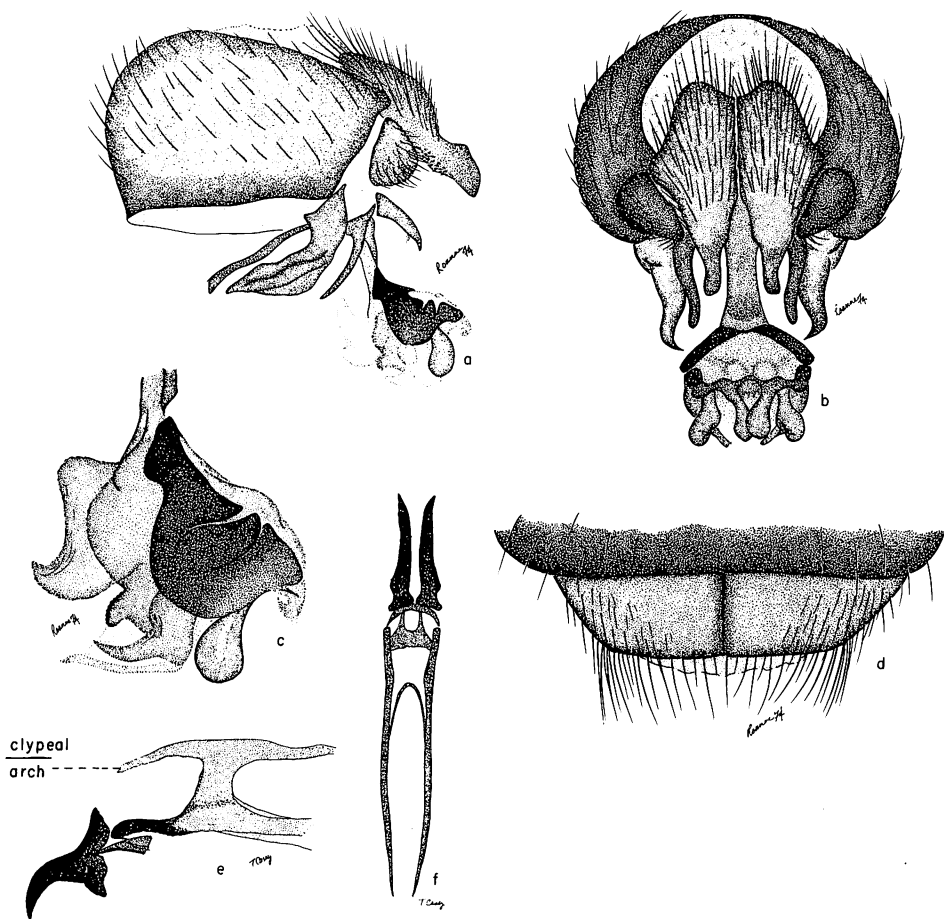


Figure 173—*Parasarcophaga* (*Thomsonia*) *argyrostoma* (Robineau-Desvoidy): a, male genitalia, lateral; b, male genitalia, end view; c, apex of aedeagus; d, apical portion of female abdomen, dorsal; e, cephalopharyngeal skeleton of 3rd instar larva, lateral; f, cephalopharyngeal skeleton, dorsal.

the sense organs on the third antennal segment refer to Slifer and Sekhon (1964).

This species fits in the key near *Bercaea haemorrhoidalis* (Fallén) and is differentiated by having the genae white haired except for a few dark hairs near eye margin; prescutellar acrostichal bristles well developed; theca of male aedeagus (fig. 173c) elongate and lobes of male cerci short, blunt (fig. 173a), not widely diverging as seen in end view (fig. 173b). Genital tergum of female (6 + 7) with hind margin entire, keeled dorsally but not excised (fig. 173d).

The mid and hind femora of males have dense long villosity on basal halves to two-thirds of posteroventral surfaces, and the apical two thirds of hind tibiae are densely long-haired over ventral surfaces. For more detailed description refer to Lopes (1958:45).

Length: body, 8.5–15.0 mm.

The cephalopharyngeal skeleton of the third instar larva is as in figures 173e,f.

Genus **PHYTOSARCOPHAGA** Rohdendorf

Phytosarcophaga Rohdendorf, 1937, Faune U.S.S.R. (N.S.) Dipt. 19(1):301, 469. Type-species, *Sarcophaga destructor* Malloch, by original designation. (The name was spelled "*destructor*" by Rohdendorf but he gave the correct name in the reference.)

Roback (1954:68) treats *Phytosarcophaga* as a synonym of *Sarcophaga*.

Lopes, Kano and Kurahashi (*in* Delfinado and Hardy 1977:579) place this in the subtribe Heteronychiina.

According to Rohdendorf the members of this genus are differentiated by having veins R_1 and $R_4 + 5$ and also the propleura setose; male aedeagus lacking a ventral membranous lobe (ventralia or vesica) (fig. 174b), and body small, not over 8.0 mm.

Phytosarcophaga gressitti (Hall and Bohart) (figs. 174a–d)

Sarcophaga gressitti Hall and Bohart, 1947, Proc. Ent. Soc. Wash. 50:131.

Type-locality: Point Ritidian, Guam (reared from corpse).

Oahu, Kauai. First recorded by Dodge (1953:132), collected September 1951, on Oahu.

Immigrant. Micronesia, Philippines, and Ogasawara Islands.

Bionomics. Occurs mostly along open beaches and is a scavenger on rotting animal matter.

A rather small species, differentiated from other sarcophagids in Hawaii by having the propleura pilose and veins R_1 and $R_4 + 5$ setulose. Head silvery pollinose, genae black setose except for white hairs on hind portion. Two complete rows and a third incomplete row of black postocular setae. Thorax with rather indistinct black vittae on mesonotum. Only the prescutellar acrostichals present. The first of the presutural and the two anterior pairs of postsutural dorsocentral bristles rather weak, scarcely longer than the surrounding setae. Notopleura with a few scattered hairs in addition to the four bristles. Propleura with numerous setae; anteroventral portion of each mesopleuron above and below the stigmatic bristle with several long setae and posterior half to two-fifths of mesopleuron densely long setose. Hind tibia of male with dense, long, ventral hairs on apical three-fifths; some of these are curled at apices and the longest are about equal in length to the basitarsus. Fifth sternum deeply cleft, each lobe densely covered with short, thick bristles on inner margins (fig. 174d). Genital segments black, the male genitalia as in figures 174a,b. Female with a pair of vertically arranged, sclerotized plates immediately above the fifth tergum. (Sixth tergum?: the spiracles are in the membrane toward the ventral margin of the next tergum.) The seventh tergum is a very short sclerite which curves around the sides of the ovipositor, and the eighth tergum is divid-

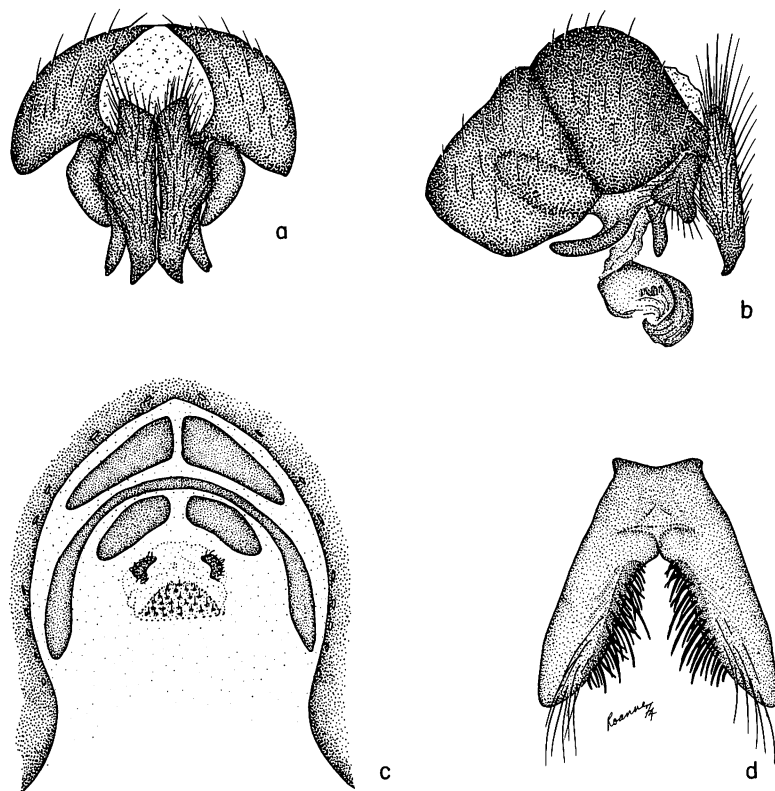


Figure 174—*Phytosarcophaga gressitti* (Hall and Bohart): a, male genitalia, end view; b, male genitalia, lateral; c, apical portion of female abdomen, end view; d, fifth sternum of male, ventral.

ed into two oblong plates above the cerci (fig. 174c). The female sterna mostly broad, wider than long.

Length: body, 7.0–8.0 mm.

Genus **SENIORWHITEA** Rohdendorf

Seniorwhitea Rohdendorf, 1937, Faune U.S.S.R. (N. S.) Dipt. 19(1):297, 467.

Type-species, *Sarcophaga orientaloides* Senior-White, by original designation,
= *Sarcophaga krameri* Boettcher.

Fitting in the group of genera which have the propleura and vein R_1 bare and the postabdomen black in both sexes. Characterized by having the phallosome of the male very large, rather bulbous, only slightly sclerotized, and twice as large as the theca (fig. 175a). Also, the ventral processes of the phallosome are short, only slightly projecting. Each lobe of cercus bearing a prominent brush of hair (fig. 175b).

Lopes et al. (in Delfinado and Hardy 1977:580) place this in the subtribe Seniorwhiteina.

Seniorwhitea krameri (Boettcher) (figs. 175a-d)

Sarcophaga krameri Boettcher, 1912, Ent. Mitt. 1:165.

Sarcophaga orientaloidea Senior-White, 1924, Rec. Indian Mus. 26:244, fig. 31.

Sarcophaga sinica Rohdendorf, 1930, Bull. Ent. Res. 21:315, fig. 1.

Oahu, Kauai, probably spread over all of the islands, including the Northwest Hawaiian Islands. First reported from Honolulu, October 1940 by Lopes (1941:56).

Immigrant: Widespread over Oriental Region; also Foochow, China.

Differentiated from other Hawaiian sarcophagids by the generic characters given above. Moderately large species with conspicuous long villosity on male legs and on underside of abdomen. Frons of male about one-fifth as wide as head. Frontal row of bristles diverging below. Three rows of black postocular setae, and genae black setose except for white hairs on hind portion. Only the prescutellar acrostichals developed and with four pairs presutural and five pairs postsutural dorsocentrals. Prosternum setose. Mid tibia with dense, moderately long villosity ventrally on apical half to three-fifths. The entire ventral surface of the hind tibia is densely covered with long hairs, those along posteroventral surface are as long as the combined length of the first three tarsomeres. Sides of fifth tergum of male densely covered with moderately long, curled hairs, and sterna densely covered with short hairs (fig. 175c). Fifth sternum of male as in figure 175d and male genitalia as in figures 175a,b.

Length: body, 7.0–15.0 mm.

Tribe SARCOPHAGULINI

Lopes (1969:29) said the species of this tribe have proclinate, fronto-orbital bristles in the male and the penis is similar in the species of all genera.

Roback (1954:59) places this in the tribe Sarcophagini and subtribe Sarcophagulina. He says, "This is one of the most primitive of the subtribes of Sarcophagini. The fifth sternite is very small and generalized and the lateral arms are still attached to the corpus and have not moved from their original position. The retention of proclinate fronto-orbitals in the male and 2 notopleural bristles also place this subtribe in a rather primitive position. It has been placed as an early offshoot of the sarcophagine-raviniine stock."

Genus **SARCOPHAGULA** van der Wulp

Sarcophagula van der Wulp, 1887, Tijdsch. Ent. 30:173. Type-species, *Musca occidua* Fabricius, by subsequent designation (Coquillett 1910:602).

For synonymy refer to Lopes (1969:29).

Downes, in Stone et al. (1965:960), placed *Sarcophagula* as a synonym under *Tricharaea* Thomson. Lopes (*loc. cit.*) recognizes these as distinct genera.

This genus fits in the grouping which has vein R_1 and propleura bare and only the prescutellar acrostichals present. It is differentiated by having a pair

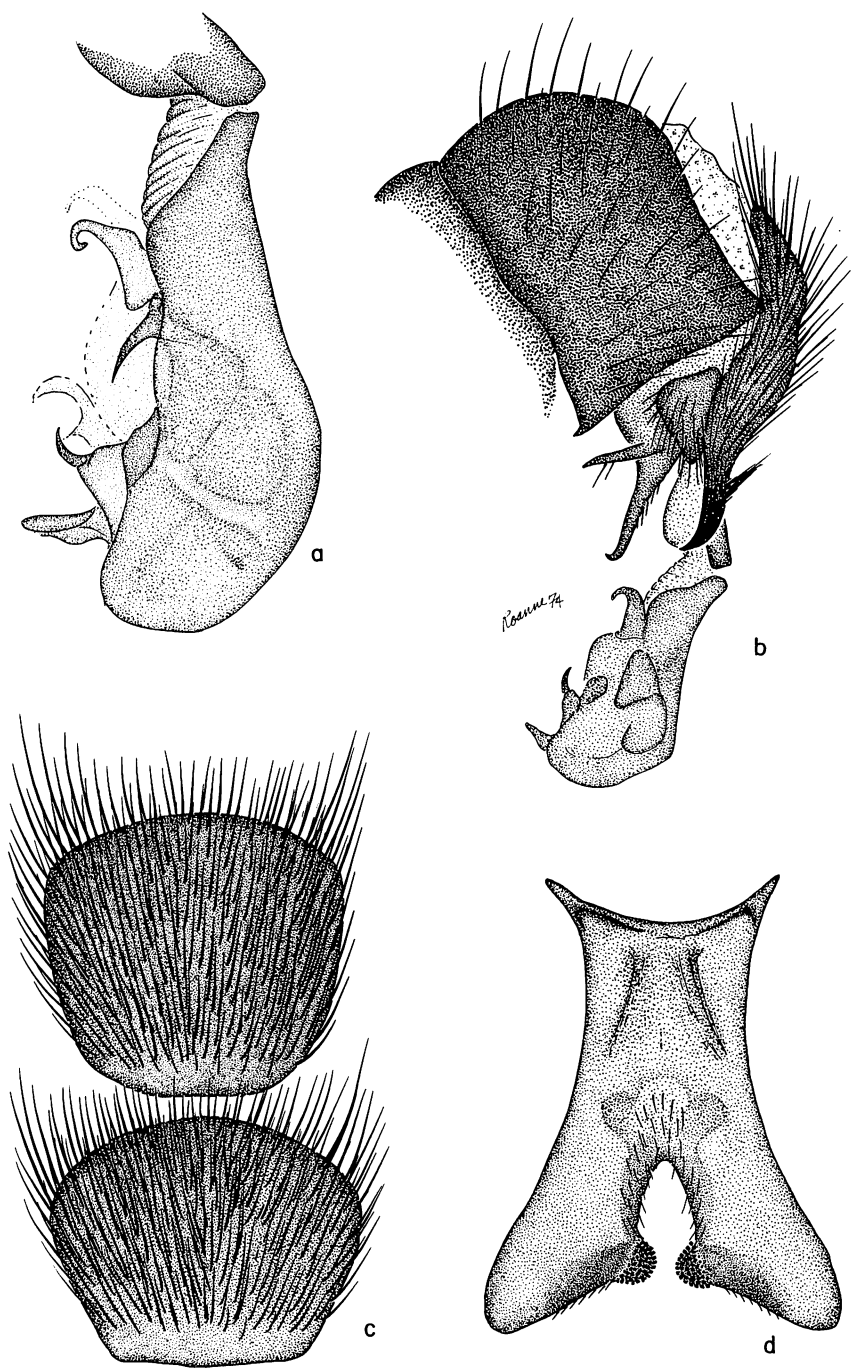


Figure 175—*Seniorwhitea krameri* (Boettcher): a, apex of aedeagus; b, male genitalia, lateral; c, third and fourth sterna of male; d, fifth sternum of male.

of proclinate, fronto-orbital bristles in both sexes; the frons of both sexes approximately equal in width; and frontal row of bristles not divergent; parafacials narrow, not much wider than third antennal segment; with only two humeral and two notopleural bristles; fifth sternum of male very small and wider than long (fig. 176b); male genitalia as in figures 176a,c. Roback (1954:59) characterizes the male genitalia as follows: "corpus closed over ventrally; vesica well developed; no juxta; ventral sclerotization forms median process and lateral arms; very little modification."

***Sarcophagula occidua* (Fabricius) (figs. 176a-c)**

Musca occidua Fabricius, 1794, Ent. Syst. emend. et aucta 4:315.

For synonymy refer to Lopes (1969:29).

Common in the lowlands on all the main islands.

First recorded by Joyce (1962) from specimens reared on dog feces, Honolulu, September 6, 1961, as *Sarcophagula* sp. prob. *occidua* Fabricius. David G. Hall, in correspondence, said he had collected this on Oahu and Hawaii in 1944 and 1945. It has been treated in later Hawaiian literature in the genus *Tricharaea*.

Immigrant. Neotropical; southern United States, Texas to Florida. Hall, in correspondence, says it also occurs on other islands in the eastern Pacific. Lopes (1958) did not list it from Micronesia.

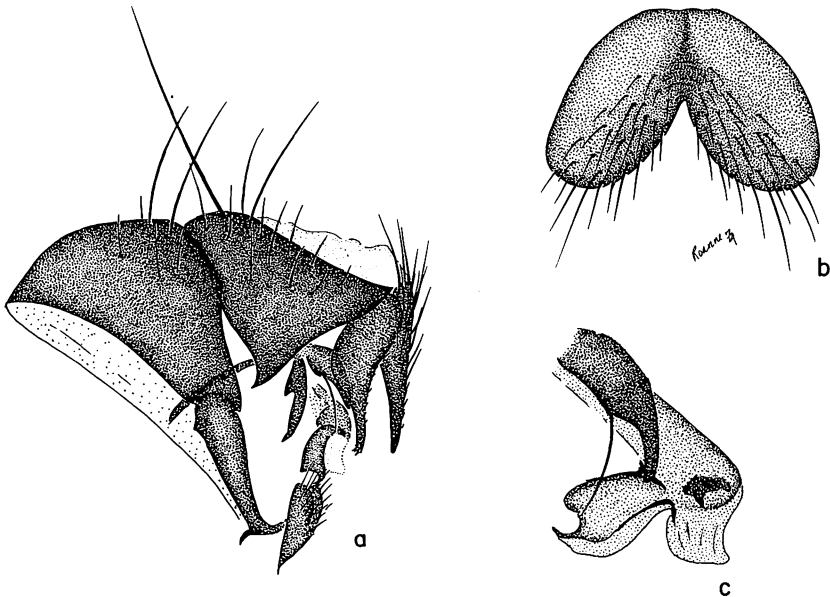


Figure 176—*Sarcophagula occidua* (Fabricius): a, male genitalia, lateral; b, fifth sternum of male, ventral; c, apex of aedeagus.

Bionomics. A dung breeder: in Hawaii it breeds commonly in dog feces (Wilton 1963). The encyrtid wasp, *Exorislobia philippinensis* Ashmead, is a common parasite of this species.

Readily recognized by their small size in combination with the bare vein R_1 ; presence of proclinate fronto-orbitals in both sexes; frons of male about equal in width to that of female, one-third head width; frontal rows of bristles parallel; occiput with scattered, but prominent black setae behind postocular row and with a few pale setae only on lower hind portion; fifth sternum tiny, wider than long (fig. 176b) and male genitalia as in figure 176a,c.

In addition, the head has 8-10 prominent bristles in vibrissal row besides the strong anterior bristle. The prosternum is bare, except for a few black marginal setae. Two prescutellar and three postscutellar dorsocentrals present. Postabdomen of both sexes black. The first sternum is bare except for a few setae, mostly on or near posterior margin. The hind margin of the fifth sternum has a rather deep V-shaped cleft, the lobes are broad and rounded (fig. 176b). The lobes of the cerci are straight, pointed with a very slight downward hook at the apex. They are densely short haired above on basal portion. The surstyli have numerous spicules around the apical portions (fig. 176a). Each posterior paramere has a large, subbasal, spine-like process on ventral margin and the ventralia of the aedeagus is well developed, terminating in a ventral hook-like process (fig. 176c).

Length: body, 3.0-5.0 mm.

Tribe TEPHROMYIINI

Characterized by Rohdendorf (1965:397) (as subtribe *Blaesoxiphina*) by "male cerci concave in middle of posterior margin, their apical parts sharply recurved, as if fractured; invariably at least two pairs of ac bristles behind suture and usually three pairs of dc bristles; propleura bare above; basal part of paraphallus always massive; membranous lobes in the form of membranous flanges or angles; postabdomen of male always small and not protruding."

Female genitalia modified into a piercer in the Hawaiian species.

Lopes et al. (*in* Delfinado and Hardy 1977:564) place the one genus introduced into Hawaii in the tribe Tephromyiini.

All of the members of this tribe are parasites of other insects.

Genus **BLAESOXIPHA** Loew

Blaesoxipha Loew, 1861, Wien. Ent. Monatschr. 5:386. Type-species, *grylloc-tona* Loew, by monotypy, = *laticornis* (Meigen).

For synonymy refer to Downes, *in* Stone et al. (1965:943).

Characterized by having the male cerci concave in middle of hind margin, the lobes strongly bent upward. The cerci are comparatively thin, rather weakly sclerotized, and the base is small. The aedeagus is shaped as in figures 177c and 178c. The fifth sternum of the male is deeply divided on hind margin (figs.

177d, 178d). Also the postabdomen of the male is small, not protruding. Sterna 6-8 are well developed in the female, the latter two are closely joined.

Three pairs of well-developed presutural and three pairs of postsutural acrostichals are present, also three pairs postsutural dorsocentrals.

Lopes (*in litt.*) says a characteristic feature of the genus is that the first instar larvae lack the clypeal arch (figs. 178e,f).

The species are apparently all grasshopper parasites. Two have been introduced into Hawaii for biological control of grasshoppers.

Subgenus **BLAESOXIPHA** Loew

According to Rohdendorf (1928) this subgenus is differentiated by having the basal part of the paraphallus rather elongate, at least 1 1/2 times longer than high; 1-2, rarely 3, postsutural acrostichals present, and sternum 7 of female often developed into a distinct ovipositor.

Blaesoxipha (Blaesoxipha) filipjevi Rohdendorf (figs. 177a-d)

Blaesoxipha filipjevi Rohdendorf, 1928, Zool. Anz. 77:26.

Blaesoxipha filipjevi Rohdendorf, 1937, Fauna de l'U.R.S.S. Insectes Diptères 19(1), Sarcophagidae Part 1:498. Error.

Purposely introduced as a grasshopper parasite, June 1970 (Davis 1971:61). Released on Oahu but not known to be established.

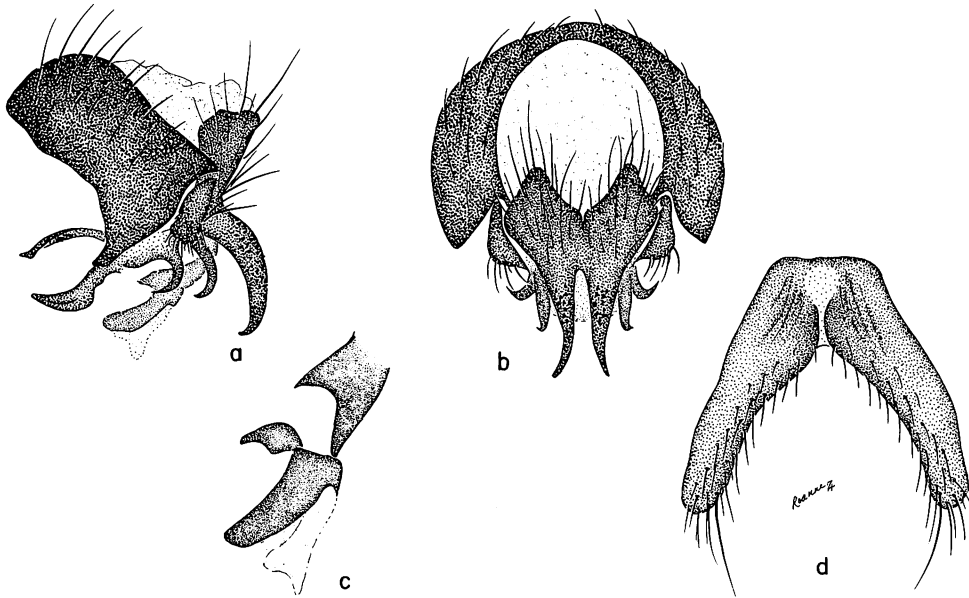


Figure 177—*Blaesoxipha filipjevi* (Rohdendorf): a, male genitalia, lateral; b, male genitalia, end view; c, apical portion of aedeagus; d, fifth sternum of male, ventral.

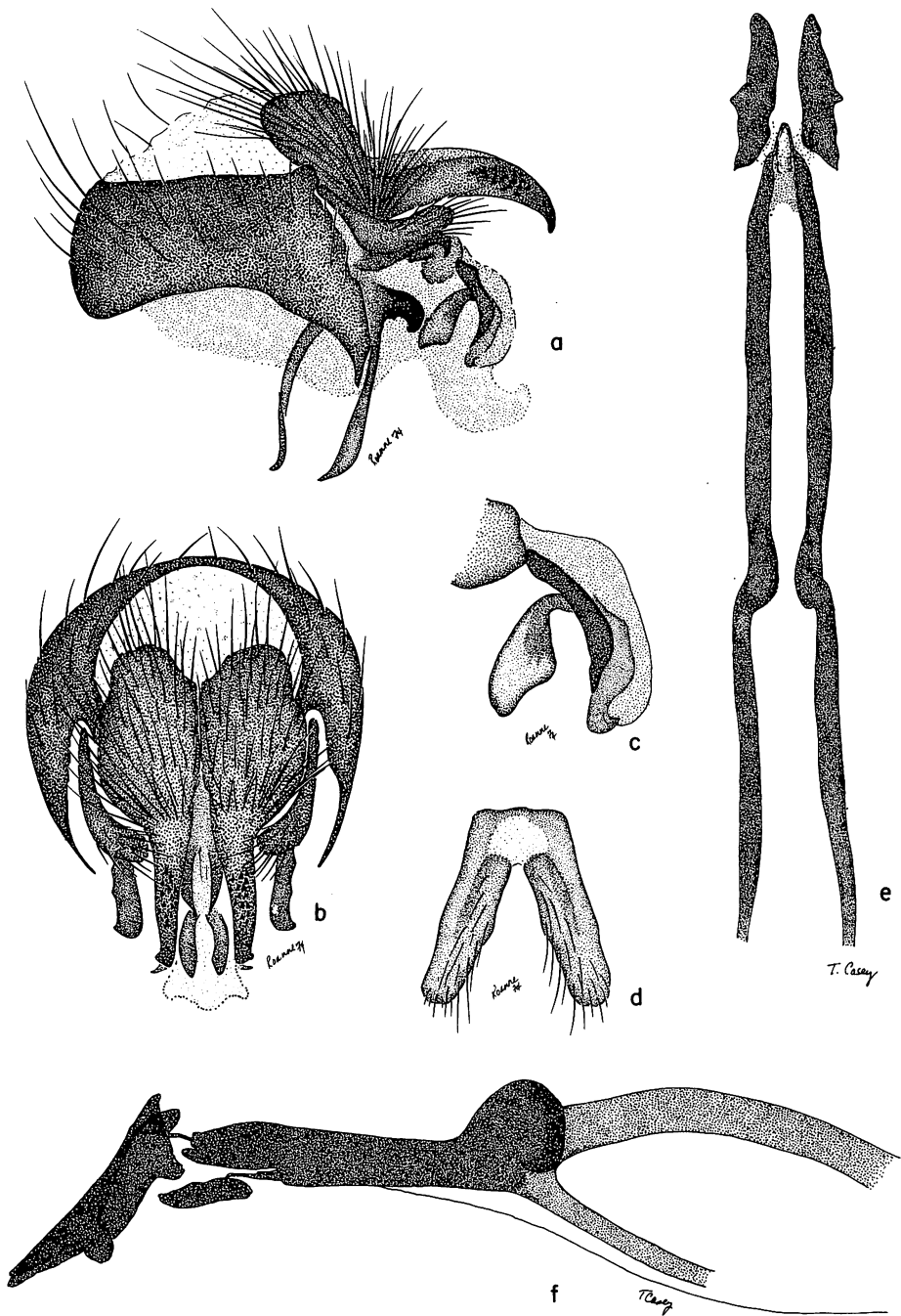


Figure 178—*Blaesoxipha lineata* (Fallén): a, male genitalia, lateral; b, male genitalia, end view; c, apical portion of aedeagus; d, fifth sternum of male, ventral; e, cephalopharyngeal skeleton, dorsal, third instar larva; f, cephalopharyngeal skeleton of larva, lateral.

Immigrant. Africa, Turkestan, Iran.

Differentiated from *lineata* (Fallén) by its smaller size, body, 4.5–5.5 mm.; arista equal or longer than anterior vibrissal bristles, and plumose on basal two-fifths; the median pair of marginal bristles on third tergum large, about as long as the segment; lobes of cerci rather gradually divergent (fig. 177b); and aedeagus shaped as in figure 177c. The fifth sternum is as in figure 177d and the other aspects of the male genitalia as in figure 177a.

***Blaesoxipha (Blaesoxipha) lineata* (Fallén) (figs. 178a–f)**

Musca lineata Fallén, 1917, Svensk. Vetensk. Acad. Handl. 1816:238.

Oahu. Purposely introduced and released on Sand Island, Honolulu, January 1967 (Chong 1968) for biological control of the vagrant grasshopper (*Schistocerca nitens nitens* Thunberg) but is not known to be established.

Immigrant. Palaearctic and Ethiopian regions.

Bionomics. This species parasitizes locusts, such as *Locusta migratoria* Linnaeus, in southern Europe and the Ethiopian region.

This species differs from *filipjevi* by being larger; body, 7.0–9.0 mm. The arista shorter than the anterior vibrissal bristles and plumose well beyond middle; the median marginal pair of bristles on third tergum much shorter than the segment; lobes of male cerci rather strongly divergent (fig. 178b) and aedeagus shaped as in figure 178c. The fifth sternum is as in figure 178d and the other aspects of the genitalia as in figure 178a. The cephalopharyngeal skeleton of the third instar larva is as in figures 178e,f.

Family TACHINIDAE

A very large, highly diversified family. The larvae are endoparasitic in arthropods, principally insects, and especially Lepidoptera and, to a lesser extent, Coleoptera, Orthoptera, Hemiptera, and Hymenoptera. From the standpoint of their use for biological control of pest species, the tachinids are the most important family of Diptera.

They are readily differentiated from other muscoid flies by the strongly developed, convex, postscutellum (fig. 193d). They are typically robust bodied, strongly bristled flies. Vein $M_1 + 2$ normally bends upward sharply beyond m crossvein greatly narrowing cell R_5 at the wing apex (fig. 193a), as is the case in Calliphoridae, Sarcophagidae, and some Muscidae. R_5 is petiolate in some genera (fig. 181a), and in a few genera (only one in Hawaii) the up-curved portion of $M_1 + 2$ is lacking (fig. 192a).

The chaetotaxy is similar to that of other muscoids. The presence or absence of setae or setulae on the prosternum, propleura, and on the upper embossed portion of the hypopleuron (beret), below and anterior to the metathoracic spiracle are important diagnostic features as also are the presence or absence and the arrangement of bristles and setae over various portions of the body.

The taxonomy of the group has been most confusing. The massive, monumental *Manual of Myiology* of Townsend (1934–1942) laid the ground

work for a radical departure from the previous concepts. Townsend divided the group into six families (plus Oestridae) and numerous tribes; also, his generic concepts were extremely restricted compared to previous workers'. Other authors have divided it into from three to sixty smaller "families" but the current practice is to recognize only one. There is little agreement among specialists concerning the subfamily and tribal arrangements. The family is so large and so complex, with such an extraordinary range of taxonomic characters that a great deal of work is needed to assess the phylogenetic values of these characters and to establish all of the higher categories on a firm basis based upon morphological and biological attributes. The delimitation of the taxonomic groups at all levels presents formidable problems.

The subfamily and tribal arrangement used here follows, for the most part, that of Sabrosky and Arnaud, *in* Stone et al. (1965:961-1108) and Crosskey, *in* Delfinado and Hardy (1977:588-699). The first authors adopted most of the tribes recognized by Townsend (1934-1942) in his *Manual of Myiology* "for present convenience, in absence of any other published arrangement of Nearctic genera." They point out that "in some tribes, the present classification can be regarded as satisfactory or reasonably so, but for many others this catalog is necessarily only a preliminary organization."

The biology of the family is complex. The females are oviparous or ovoviviparous and as many as ten distinct types of oviposition habits are displayed (refer to Townsend 1908, 1934-1942; Pantel 1910; Baer 1920/1921; Emden 1954; and Mesnil 1944-1963). The following types are exhibited by the species present (or which have been introduced) in the Hawaiian Islands.

1. Mature eggs or larvae laid on bodies of host, the larvae bore through the integument. Parasites of Lepidoptera (*Lespesia*, *Exorista*, *Winthemia*, and *Actia*) and Hemiptera (*Trichopoda*).
2. Many small eggs laid on vegetation and ingested by host. Parasites of Lepidoptera (*Gonia*, *Pseudogonia*, and *Chaetogaedia*).
3. Eggs or newly hatched larvae injected within the integument of the host. Parasites of Lepidoptera (*Eucelatoria*) and Hemiptera (*Leucostoma*).
4. First instar larvae deposited on host plants, or nest, and larvae attach to and bore into host. Parasites of Lepidoptera (*Archytas*); of Weevils (*Lixophaga*) and of Hymenoptera (*Euvespivora*).

All of the species present in Hawaii are immigrants, almost all have been purposely introduced from over much of the world for biological control of pest species of Lepidoptera, Coleoptera, and Hemiptera. One parasite of wasps has been accidentally introduced.

Several species which were purposely introduced for biological control many years ago obviously have not become established and are not being included in the key or the text. Parasites of *Adoretus* and *Anomala* beetles (Scarabaeidae): *Hamaxia incongrua* Walker (as *Ochromeigenia ormioides* Townsend) introduced from Formosa on several occasions between 1926 and 1930; also *Dexia* sp. and *Prosenia* sp., from the Philippines in 1916 (refer to Williams 1931:374). Also a

parasite of the sugar cane borer (*Rhabdocnemis obscurus* [Boisduval]), *Myiophasia metallica* (Townsend) introduced from Mexico (refer to Williams 1931:376). *Myiophasia* sp. "prob. new" was brought in from Trinidad as a possible agent for control of pest species of nitidulid beetles but was never released from the quarantine laboratory (Davis 1972).

Erynnia tortricis (Coquillett) was reared from a gelichiid moth (*Anarsia lineatella* Zeller) on a store-bought peach, probably from California (Hardy 1957). The species is obviously not established and is not being treated.

The following recent introductions have not yet been recovered in the field but are being included in the key and text since they may possibly be established: *Exorista sorbillans* (Wiedemann); *Eucelatoria* n. sp.?, from Arizona; *E.* n. sp.?, from Mexico; and *Lixophaga beardsleyi* n. sp., from New Guinea.

Three subfamilies, ten tribes, thirteen genera, and eighteen species are represented in Hawaii.

KEY TO GENERA AND SPECIES OF TACHINIDAE IN HAWAII

1. Hind tibiae not with feather-like bristles. Abdomen with strong bristles. Wings hyaline or nearly so 3
- Hind tibiae with a dorsal row of strong, flat, feather-like bristles (fig. 182d). Abdomen lacking bristles. Wings mostly dark brown (figs. 181a and 182a). **Trichopoda** Berthold. 2
- 2(1). Hyaline posterior margin of wing narrow, the brown coloring extending well into apical portion of cell 2nd M_2 beyond m crossvein and upswing of vein $M_1 + 2$. Male wing with a prominent yellow mark through antero basal half (fig. 181a). Abdomen rather slender, nearly straight-sided, proportion of length to width equals 11.5:4.8. Females with bases of all femora broadly rufous and with fifth tergum of abdomen all black and fourth predominantly so **pennipes** (Fabricius).
- Hyaline posterior margin rather broad, especially in females, apical portion of cell 2nd M_2 mostly hyaline. No sexual dimorphism in male wings (fig. 182a). Abdomen broader, sides slightly rounded, proportion of length to width equals 11.5:6.7. Female femora black except narrow bases of hind and a small spot of rufous on basoventral portion of mid; fourth tergum rufous except for a faint tinge of brown in middle, and fifth rufous on basal half and on sides **pilipes** (Fabricius).

- 190c) and broad, much wider than third antennal segment. Parafrontalia with 3 to 4 irregular rows of bristles or scattered bristles and black hairs (figs. 190c and 191b). 3 notopleurals. 8
- Second joint of arista tiny, not much longer than 1st, and only a fraction of the length of 3rd (fig. 187c). Parafacials devoid of scattered setae and narrow by comparison, not, or scarcely wider than third antennal segment. Only 2 notopleurals . . 10
- 8(7). Facial ridge bare except for a few setae above vibrissae. Ocellar bristles strong and reclinate (figs. 190c, 191d). Fifth tergum black. Basicostal scale mostly or entirely yellow. 9
- Facial ridge with a row of strong bristles. Ocellar bristles rather small, proclinate (fig. 191b). Fifth tergum rufous. Basicostal scale and epaulet black **Chaetogaedia monticola** (Bigot).
- 9(8). Arista elbowed, second joint about equal or longer than third. Front inflated, with numerous scattered bristles and hairs; parafacials and parafrontals broad, equal in width to eye (fig. 190c). Mentum elongate, distinctly longer than palpi. Terga 1-4 rufous except for a black longitudinal vitta down middle. Epaulet yellow
- **Gonia longipulvilli** Tothill.
- Arista not elbowed, second joint about 1/2 third. Front not inflated, with about 3 irregular rows of bristles; parafacials and parafrontals much narrower than eye (fig. 191d). Mentum not longer than palpi. Abdomen black except for tinge of rufous on sides of tergum 3 and with basal portions of terga 3-5 broadly silvery gray pollinose. Epaulet black.
- **Pseudogonia rufifrons** (Wiedemann).
- 10(7). Facial ridge with a row of prominent bristles extending over at least lower 2/3 (fig. 188b). 11
- Facial ridge bare except for a few black setae above vibrissae (fig. 187c) 14
- 11(10). Frontal row of bristles continuing straight onto upper portion of parafacialia almost in line with row of bristles on facial ridge (fig. 185a,b). Occiput lacking black setae behind the occipital row; outer vertical bristles weak, scarcely larger than oc-

- capital setae. Ocellar bristles usually weak or absent. Only three postsutural dorsocentrals and three sternopleurals. Apical scutellars lacking. Females with a prominent piercing structure developed (fig. 185d). **Eucelatoria** Townsend 12
- Frontal rows divergent on lower portion, not lined up with bristles on facial ridge (fig. 188b). Occiput with a row of black setae behind the occipital row. Outer vertical and ocellar bristles strong (fig. 188c). Four postsutural dorsocentrals and four sternopleural bristles. Apical and secondary scutellars well developed. Females lacking a piercing structure. **Lespesia archippivora** Riley.
- 12(11). Larger species; body, 7.5–8.5 mm. Lateral margins of female terga 3 and 4 with two or more rows of strong, stout spines (figs. 185d, 186f) 13
- Smaller species; body, 4.25–5.25 mm. Lateral margins of terga 3 and 4 with only a single row of strong spines (fig. 186e). Male genitalia and fifth sternum as in figures 186a and 186c
 n. sp.?, "Arizona."
- 13(12). Piercer of female rather short and broad, about two times longer than greatest width. Margins of terga 3 and 4 with three to four rows of strong spines. Male genitalia and fifth sternum as in figures 186b and 186d. n. sp.?, "Mexico."
- Piercer comparatively slender, three times longer than wide. Only two rows of strong spines on margins of 3 and 4. On all the main islands
 **armigera** (Coquillett).
- 14(10). Four pairs postsutural dorsocentrals, six or more hypopleurals. Upcurved portion of last section of vein $M_1 + 2$ distinctly longer than straight portion, cell R_5 ends before wing apex (fig. 189c). Two median posterior bristles on front tibia 16
- Only three pairs postsutural dorsocentrals and 3 to 4 hypopleurals. Upcurved portion of vein $M_1 + 2$ about equal in length to straight section after m crossvein. Cell R_5 ends at or very near wing apex (fig. 187a). Anterior margin of wing brown. Only one median posterior on front tibiae. **Lixophaga** Townsend 15
- 15(14). Scutellum largely subopaque, subshining brown to blackish pollinose, with gray pollen only at apex,

the gray mostly confined to area between the large apical bristles and not covering more than apical third of scutellum. Pollinosity of mesonotum typically gray. Hypandrium of male is 1.57 times longer than wide, the anterior end broadly rounded (fig. 187b). Mouthhooks of third instar larvae are 0.24 mm. long and the cephalopharyngeal skeleton as in figure 187i. Posterior spiracles circular, the stigmata are rather widely separated by about 0.146 mm. (fig. 187k)

. **sphenophori** (Villeneuve).

Scutellum gray over apical three-fifths to two-thirds, contrasting from the black basal portion. Pollinosity of mesonotum and scutellum with a distinct golden sheen. Male hypandrium shorter, more pointed apically (fig. 187f), ca. 1.18 longer than wide. Third instar mouth hooks shorter, 0.16 mm. in length. Cephalopharyngeal skeleton as in figure 187h. Posterior spiracles elongate, slightly kidney-shaped and the stigmata rather closely spaced, separated by ca. 0.065 mm. (fig. 187j) . .

. **beardsleyi** n. sp.

- 16(14). Three sternopleural bristles; mesopleura entirely black-haired; parafacialia lacking fine hairs; m crossvein straight. At least tergum 3 with strong apicomedian bristles, in both sexes 17

Only two sternopleurals; hind margin of each mesopleuron with long, fine, yellow hairs; parafacialia with numerous fine hairs; m crossvein rather sinuate (fig. 193a). Only abdominal terga 4 and 5 with apical bristles in male

. **Winthemia diversoides** Baranov?

- 17(16). Frontal row of bristles extending on upper parafacialia to slightly beyond apex of 2nd antennal segment (fig. 184a). No dark line or fold extending from bend of vein $M_1 + 2$. Legs yellow to rufous, abdomen mostly so with a black vitta down middle of terga. The three sternopleural bristles in a line. Basicostal scale and epaulet yellow to rufous. Mesonotum yellow-gray pollinose with 4 narrow, indistinct and incomplete, dark gray vittae. Eyes bare. No carina down middle of face. No apicomedian bristles on tergum 1 + 2

. **Euvespivora decipiens** (Walker)?

Frontal row extending on parafacialia half the

"Ocellar bristles reclinate; lunule setose; antennae short extending a little below mid face; arista short with small proximal segments; clypeus only slightly depressed; parafacial bare; eye large, reaching well below vibrissal level; first posterior cell closed with long petiole reaching costa before extreme wing tip; calypters strikingly enlarged in male and female with a pair of horizontal pincer-like cerci at the tip of the abdomen." The forcipate plates apparently represent the sixth tergum. The needle-like piercing structure seems to arise from the inner basal margin of the seventh sternum. The apical scutellars are large, about equal in size to preapical pair.

For a synopsis of the genus refer to Reinhard (1956).

Two immigrant species are established in Hawaii.

***Leucostoma aterrimum* (Villers) (figs. 179a-e)**

Musca aterrima Villers, 1789, Caroli Linnaei entomologia 3:548.

For synonymy refer to Reinhard (1956:160) and to Sabrosky and Arnaud, in Stone et al. (1965:976).

Probably widespread throughout the islands; recorded from Kauai, Oahu, Hawaii.

Immigrant. Palaearctic and Nearctic regions.

This species was first recorded (unidentified) by Bridwell (1920) and by Swezey (1921 and 1922), bred from adult *Liorhyssus hyalinus* (Fabricius) (as *Corizus*) on Oahu. In the 1922 note, Swezey referred to this as *L. atra*, determined by Aldrich. According to Bryan (1934:416), "In 1932 Aldrich corrected this identification to *L. aterrima*, and stated that the *Leucostoma analis* (Meigen), doubtfully recorded by Grimshaw (1901, p. 20) was a synonym. The small unidentified littoral species of Perkins (1913, p. clxxxiv) may also be *L. aterrima*."

Bionomics. Reared from the coreid bug *Liorhyssus hyalinus* (Fabricius) in Hawaii.

Characterized by having last two segments of male abdomen gray-white pollinose; thorax and abdomen, especially on sides and venter, rather densely long haired; 4th and 5th sterna each with four or more long, preapical hairs in addition to the pair of bristles; parafrontalia with three rows of setae on lower portion, in addition to frontal row of bristles; lobes of cerci curved downward, as seen from lateral view and hypandrium as in figure 179b. Females with abdomen comparatively long and slender. Tapered from base to apex, about three times longer than wide with terga, except for 5, as long as wide (fig. 179c). Fourth tergum about 2 1/2 times longer than fifth and the forcipate structures at end of abdomen are longer than fifth. Bristles on posterior margin of terga recumbent, directed posteriorly, except for the erect median pair on apices of terga 2 and 3. The forcipate structures are rather strongly bowed (fig. 179c). Fourth sternum only slightly broadened apically and about four times longer than wide. The seventh sternum not conspicuously bilobed, only partially divided at middle of hind margin (fig. 179e). The male genitalia from end view are as in figures 179a,b. Head as in figure 179d.

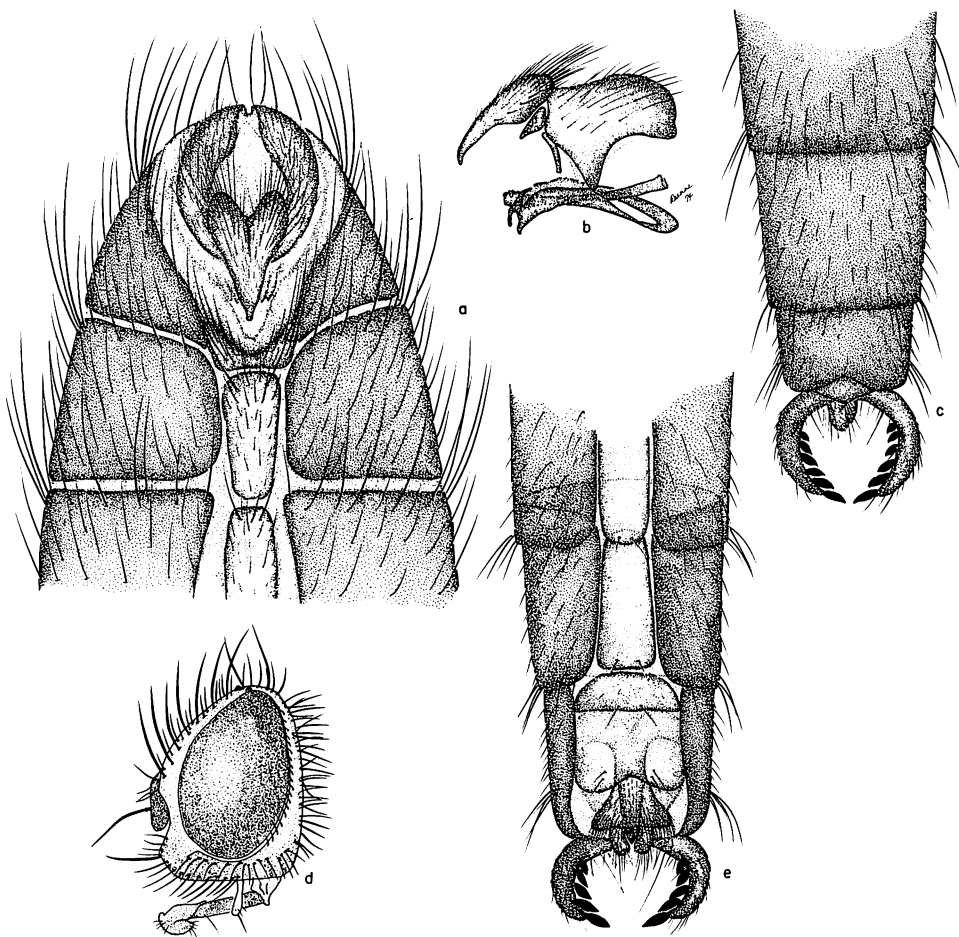


Figure 179—*Leucostoma aterrimum* (Villers): a, abdomen of male, ventral; b, male genitalia, lateral; c, female abdomen, dorsal; d, head of male, lateral; e, female abdomen, ventral.

Length: 4.0–5.0 mm.

For other descriptive details refer to Reinhard (1956:160).

***Leucostoma simplex* (Fallén) (figs. 180a–e)**

Ocyptera simplex Fallén, 1820, *Rhizomyzides Sveciae*, 8.

Leucostoma atra Townsend, 1891, *Trans. Amer. Ent. Soc.* 18:380.

Oahu, Kauai, Hawaii; probably on all of the main islands. Also seen from Laysan.

Immigrant. Palaearctic and Nearctic regions.

First recorded by Swezey (1933) from one specimen collected at Honolulu in 1920, determined by Aldrich.

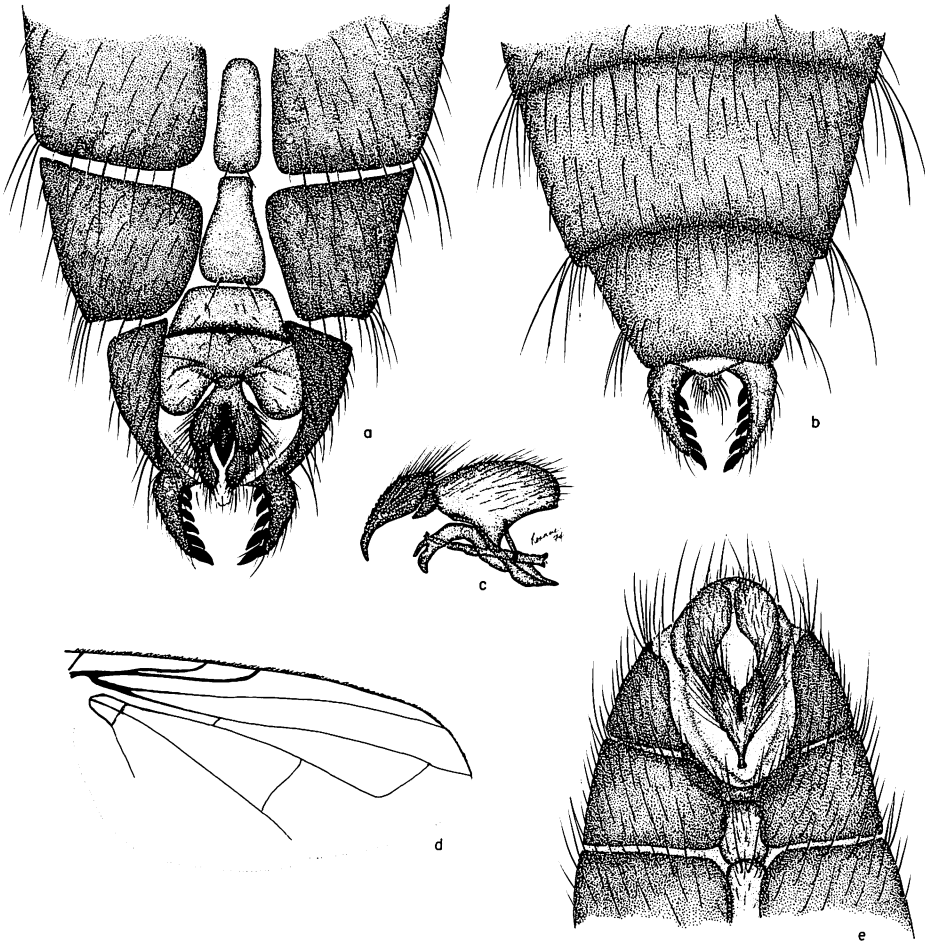


Figure 180—*Leucostoma simplex* (Fallén): a, female abdomen, ventral; b, female abdomen, dorsal; c, male genitalia, lateral; d, wing; e, male abdomen, ventral.

Bionomics. No host information is available for this species in Hawaii. Reinhard (1956:160) reported it having been reared from nabid bugs in eastern United States.

The males are characterized by having the abdomen entirely shining black, lacking pollinosity; by comparison with *aterrimum*, the thorax and abdomen are rather sparsely haired; fourth sternum lacking setae, only apical bristles present and fifth sternum with one small seta; parafrontalia with only one irregular row of setae in addition to the frontal bristle row; lobes of cerci nearly straight and genitalia as in figures 180c,e. Wing as in figure 180d.

Females with the abdomen ordinary in shape, about two times longer than wide, slightly rounded on sides, broadest at about segment 3 and with terga 1 + 2-4 much wider than long with strong erect posterior marginal bristles on

terga 2-5. The terga are much wider than long. Fourth tergum about two times longer than fifth, measured to middle of posterior margin. Forcipate appendages about as long as fifth tergum and not so conspicuously bowed (fig. 180b). Seventh sternum bilobed, deeply divided in middle of hind margin and fourth sternum expanded posteriorly, about two times longer than wide (fig. 180a).

Length: 3.0-4.25 mm.

For other descriptive details refer to Reinhard (1956:159).

Tribe TRICHOPODINI

Characterized by having the abdomen comparatively long and slender, straight-sided, and lacking distinct bristles; with six segments visible in male, from dorsal view, and with the membrane exposed on the venter of at least the first three segments; first antennal segment very short, flush with head; proboscis not longer than head height; frontal row of bristles ending at antennal bases; only one intraalar bristle; prosternum bare; and hind tibiae usually with an anterodorsal row of wide, flat, bristles (fig. 182d).

The members of this tribe are parasites of adult Hemiptera (Heteroptera). One genus is represented in Hawaii.

Genus TRICHOPODA Berthold

Trichopoda Berthold, 1827, Latreille's *Natürliche Fam. der Thierreichs*, p. 508. Type-species, *Thereva plumipes* Fabricius, by subsequent designation (Coquillett 1910:616).

Trichiopoda, emend.

Polistomyia Townsend, 1908, *Smithsn. Inst., Smithsn. Misc. Collect.* 51(2):132. Type-species, *Trichopoda trifasciata* Loew, by original designation, = *plumipes* (Fabricius).

As discussed by Sabrosky (1950), the members of this genus are characterized by having a row of large, flattened, scale-like, closely set, dorsal bristles on hind tibia (fig. 182d); area behind hind coxae before first abdominal sternum membranous, sunken in middle; wings largely infuscated (figs. 181a and 182a); cerci of male fused, shaped as in figure 182c; cerci of female thin, plate-like, sparsely haired and eighth sternum of female subquadrate, broadly rounded apically (fig. 181c).

Also only four scutellar bristles are present. The abdomen has six terga distinctly visible from dorsal view, especially in males, and in males 7 + 8 forms an oblique, nearly bare platform above and posterior to the genitalia.

Subgenus GALACTOMYIA Townsend

Galactomyia Townsend, 1908, *Smithsn. Inst., Smithsn. Misc. Collect.* 51(2): 135 (as genus). Type-species, *Trichopoda radiata* Loew, by original designation, = *lanipes* (Fabricius).

Trichopodopsis Townsend, 1913, J. N. Y. Ent. Soc. 21:148, 313. Type-species, *Musca pennipes* Fabricius, by original designation.

As characterized by Townsend, the males have the abdomen flattened, the wings infuscated to inner margin, milky radiate on a yellow or fuscous background, with the milky radiations conspicuous and the yellow less pronounced. The hind femora strongly ciliate on posterior half, the bristles are flattened. The males have the membrane plainly visible on the venter of the abdomen and all sterna free. Segment 6 + 7 occupies a ventral position and forms base of genitalia. In females, the abdomen cylindrical, wings wholly black, except for narrow inner border, without yellow coloring.

In the species at hand, the hind tibia has one median, posterodorsal bristle; one small anteroventral at apical 1/4 and no other bristles except for scale-like row; also only one postsutural intraalar bristle present and the postalar declivity with a few fine hairs in upper median portion beneath the outer postalar bristles.

***Trichopoda (Galactomyia) pennipes* (Fabricius) (figs. 181a-e)**

Musca pennipes Fabricius, 1781, Spec. insect. exhib. eorum diff. spec. syn., auct. loca natalia, metamorph. 2:450. Type-locality: North America.

Maui, purposely introduced from Florida and released November 1963 on Oahu (Davis 1964a, 1964b, 1967:12; Davis and Krauss 1964:395) for biological control of the southern green stinkbug *Nezara viridula* (Linnaeus). Known to be established only on Maui.

Eastern U.S., Kansas to Connecticut, south to Florida and into Mexico.

Bionomics. A parasite on adult stinkbugs. See remarks under *pilipes*.

Differentiated from *pilipes* by having the hyaline posterior margin of the wing narrow, the brown coloring extending well into the apical portion of cell M_2 beyond m crossvein and the bend of vein $M_1 + 2$. Male with a very prominent yellow mark through antero basal half of wing (fig. 181a). Abdomen rather slender, nearly straight-sided, proportion of length to width equals 11.5:4.8. Females with bases of all femora broadly rufous and with fifth tergum all black and fourth predominantly so. Also the seventh sternum of the female is more distinctly narrowed from base to apex as in figure 181c. The male genitalia are as in figures 181b,d. Otherwise fitting the characteristics of *pilipes*. The head is as in figure 181e.

***Trichopoda (Galactomyia) pilipes* (Fabricius) (figs. 182a-f)**

Thereva pilipes Fabricius, 1805, Syst. Antliat., 220.

Oahu, Kauai, Maui, Molokai, Lanai, Hawaii.

Purposely introduced from Antigua, West Indies, released April 3, 1962 (Davis 1963a,b; 1964b; 1967:12) at two sites on Oahu for biological control of the southern green stinkbug, *Nezara viridula smaragdula* (Fabricius).

Bionomics. This species established very quickly and has been a very effective

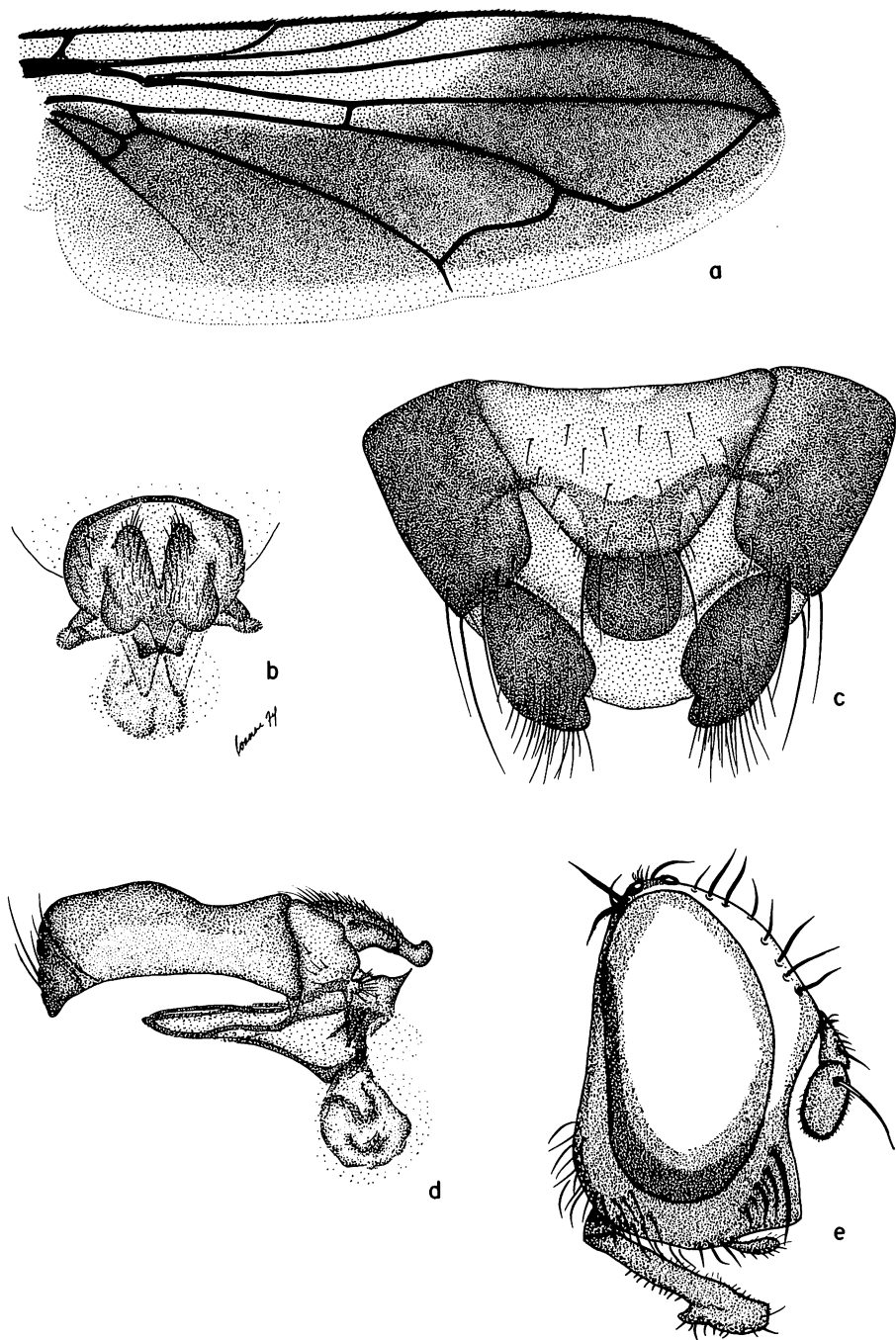


Figure 181—*Trichopoda pennipes* (Fabricius): a, wing of male; b, male genitalia, end view; c, female ovipositor, ventral; d, male genitalia, lateral; e, head, lateral.

tive parasite of the southern green stinkbug. The eggs are laid directly on the adult bugs, as many as 237 eggs have been recorded on one *Nezara* (Mitchell 1964). It has been recorded parasitizing the endemic koa bug (*Coleotichus blackburniae* White) (Beardsley 1965:8), and it is probable that it may also parasitize the endemic *Oechalia*. The adults are attracted to various flowers such as goldenrod (*Solidago altissima* Linnaeus) and Ilima (*Sida fallax* Wulp) in large numbers for feeding.

Beardsley (1965:3) recorded finding "two tachinid eggs, apparently of *Trichopoda pennipes* (F.)" (this probably was *pilipes*) on the head of an adult female Australian mantis, *Tenodera australasiae*. The mantis died after about a week in captivity and no parasites emerged.

The encyrtid wasp *Exoristobia philippinensis* Ashmead has been reared from this species in Hawaii.

This has been previously referred to in the Hawaiian literature as *Trichopoda pennipes* var. *pilipes* (Davis 1964b:373). It is obvious that *pennipes* and *pilipes* represent two distinct species; aside from the morphological characters pointed out below, the two populations from Florida (*pennipes*) and the West Indies (*pilipes*) would not interbreed in the laboratory.

Readily differentiated from *pennipes* (Fabricius) by lacking sexual dimorphism in the wings of the male; abdomen of both sexes distinctly broader, with sides slightly rounded and proportion of length to width, measured through terga 3, is 11.5:6.7, compared to 11.5:4.8 for *pennipes*; the golden pollen of parafacialia ending at about upper two-thirds of front, well before the ocellar triangle, not extending to a level with lower ocellus; the hyaline posterior margin of wing rather broad, apical portion of cell 2nd M₂ mostly hyaline (fig. 182a) rather than hyaline posterior margin of wing narrow (fig. 181a); females with bases of femora all black except for narrow bases of hind; tergum 4 rufous except for faint tinge of brown on posteromedian portion and tergum 5 rufous on basal half and on sides, rather than females with bases of femora broadly rufous and tergum 5 all black and 4 mostly black. I see no striking differences in the genitalia. The various parts seem to show some differences as shown in figures 182c and f, and it appears that the surstyli are more prominent and have more conspicuous black setae on *pennipes* than in *pilipes*. In the female, the seventh sterna are distinctly different in the two species; in *pilipes* the sclerite is almost quadrate (fig. 182e) only slightly narrowed at the extreme posterior portion, whereas in *pennipes* the sides are sharply tapered from base to apex of sclerite (fig. 181c).

In addition to the above, occiput rather narrow, concave on upper median portion and on upper half with only a few scattered, short, black setae behind the postocular row, lower two-fifths of occiput with short yellow hairs, these extend over the genae. Front opaque black except for the gray-golden lower one-half to two-thirds of the parafrontalia. Front about equal width in both sexes, at narrowest point about two times wider than ocellar triangle. Front with a row of 6-8 bristles extending to level of base of antennae. Ocellar bristles proclinate. Face densely gray pollinose, completely obscuring the

mostly yellow ground color. Palpi yellow, only slightly enlarged at apices. Mentum shining black, about equal in length to palpi. Vibrissae extending on face considerable distance above the oral margin. Antennae as in figure 182b. Thorax subopaque black on the dorsum with golden pollen extending from each notopleuron across the mesonotum at level of suture, also extending

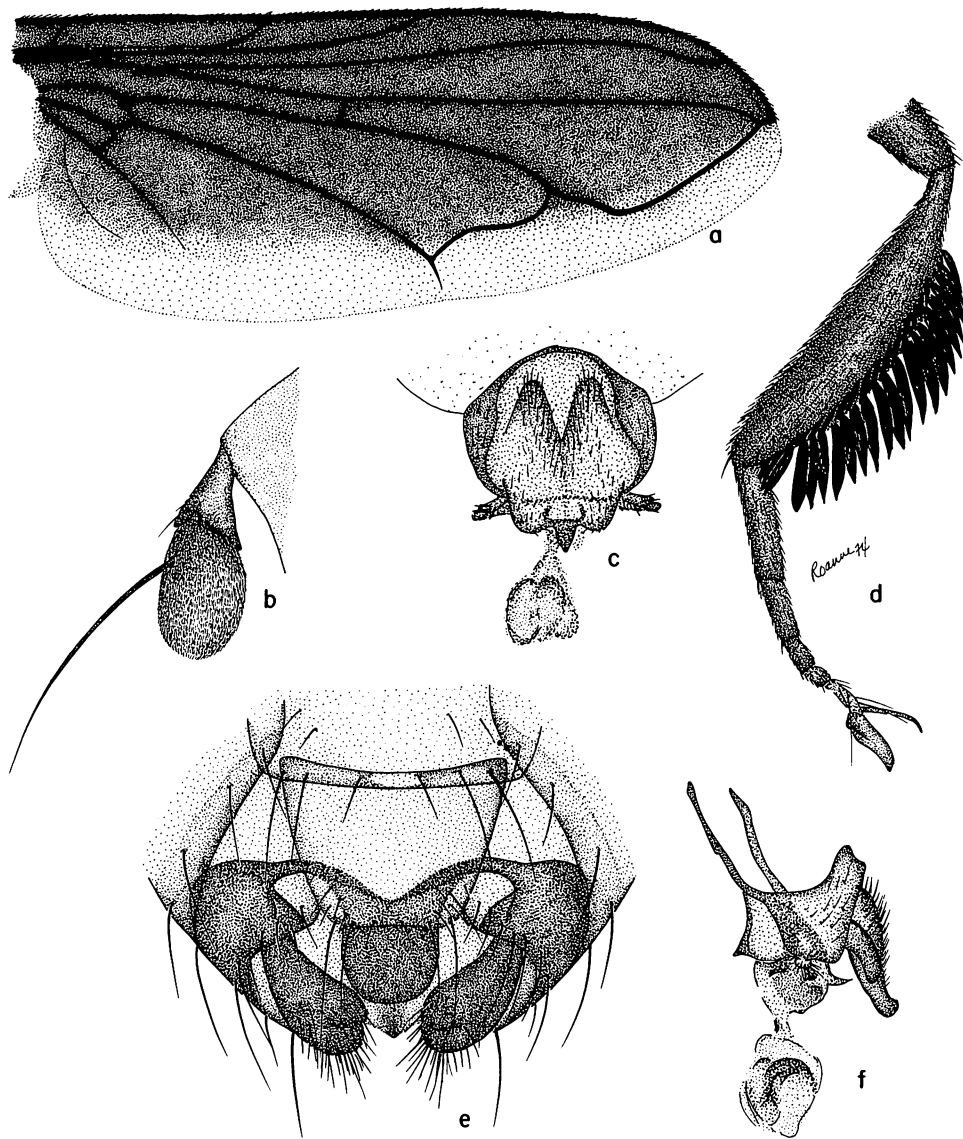


Figure 182—*Trichopoda pilipes* (Fabricius): a, wing of male; b, antenna; c, male genitalia, end view; d, hind tibia and tarsus; e, apex of female abdomen, ventral; f, male genitalia, lateral.

above and behind each humerus and with two golden vittae extending to anterior margin at about level of dorsocentral bristles; also with a median, gray vitta extending as a long pointed triangle almost to anterior margin. Postsutural area also with two indistinct pale gray-golden vittae continuing on from the presutural lines and extending to the dorsocentral bristles. Also the area between the postsutural vittae is gray-golden pollinose (according to the direction of the light) across the median portion. Only one pair of well-developed prescutellar dorsocentrals and one pair acrostichal bristles present; also one pair of small, rather seta-like, presutural dorsocentral and sometimes with a small bristle, seta-like, immediately in front of the posterior bristles. Wings almost entirely dark colored, as in figure 182a, with only two or three small inconspicuous black setae on node at base of vein $R_4 + 5$. Petiole of cell R_5 very short, less than half the length of the r-m crossvein. Male abdomen typically all yellow, including the terminalia, frequently tinged brown to black on posterior median portions of terga 4 and 5. This coloration is variable, two small male specimens are on hand which have the abdomen almost entirely black. The fifth abdominal sternum is about one-half wider than long with the hind margin almost straight and with only a few short, inconspicuous setae scattered on sides. Male genitalia as in figures 182c,f. Female terminalia as in figure 182e.

Length: 6.0–8.5 mm.; average 8.0 mm.

Subfamily TACHININAE

The only representative of this subfamily in Hawaii is characterized by having the propleura haired, the prosternum bare, the prealar bristle smaller than the first postsutural dorsocentral, and sterna exposed, not covered by terga.

These are parasites of many kinds of lepidoptera larvae, especially cutworms, armyworms, and other noctuids.

Tribe DEJEANIINI

Characterized by having inner vertical bristles very strong and cruciate; abdominal bristles strong, spine-like; no facial carina; palpi and rostrum elongate, the former spatulate; parafacialia haired; propleura pilose and prosternum bare.

Parasites of caterpillars such as *Catocala*, *Malacosoma*, *Cirphis*, *Spodoptera*, etc.

Genus ARCHYTAS Jaennicke

Archytas Jaennicke, 1867, Senckenb. Naturf. Gesell. Abhandl. 6:392. Type-species, *bicolor* Jaennicke, by monotypy, = *diaphanus* (Fabricius).

Pseudoarchytas Townsend, 1915, Insec. Inscitiae Menstruus (1914) 2:185.

Readily differentiated from other tachinid genera in Hawaii by the short, rather kidney-shaped, third antennal segment; with the third subequal in length to the second (fig. 183b); and by the strongly protruded epistoma, as

seen in lateral view. In addition, these are large, robust, strongly bristled flies, including strong bristles on sterna. The rostrum is slightly longer than the oral margin and the labellae small, rather poorly developed. The palpi extend slightly beyond the epistoma and are enlarged apically. Ocellar bristles weak or absent. Eyes bare, parafacials rather densely fine-haired and face not carinate. Middle of propleura haired and prosternum bare, also postalar declivity with fine hairs. Wings with bend of vein $M_1 + 2$ acute and with a short spur and a darkened fold. Hind margin of second abdominal tergum lacking bristles except for one on each side. Tergum 3 with two median, plus one on each side of hind margin.

For a revision of the American species refer to Curran (1928).

Archytas cirphis Curran (figs. 183a-d)

Archytas cirphis Curran, 1927, Proc. Haw. Ent. Soc. 6:497.

Widespread on all the main islands.

Immigrant. Mexico. Purposely introduced into Hawaii, February 1924 (Swezey 1926:226; 1927) for biological control of armyworms.

Bionomics. An extremely valuable parasite of caterpillars, especially the armyworms, *Cirphis unipunctata* (Haw.) and *Spodoptera mauritia* (Boisd.). The female deposits larvae on grass or other vegetation where cutworm caterpillars may be found; when the larvae come in contact with a host caterpillar they fasten onto it and penetrate its body. The fly larva does not attain full growth until the host reaches the pupal stage (refer to Williams 1931:293). The type series were reared from pupae of *Cirphis latiuscula* and *C. cholica*, in Mexico.

This is the largest of the Tachinidae established in Hawaii. It is readily recognized by its size, in combination with the short third antennal segment; strongly protruded epistoma (fig. 183b); ocellar bristles absent; subshining, reddish black abdomen; and other characters brought out under the generic discussion.

This belongs in the *apicifer* (Walker) species group by having the pleura yellowish pilose; the thorax entirely pollinose and abdomen shining reddish black with the fifth tergum pollinose as seen in indirect light. It is differentiated by the details of the male genitalia, by having the basal lobe of the surstylus strongly swollen, much shorter than the narrower apical lobe, and the aedeagus as in figure 183c.

Head shaped as in figure 183b. Predominantly yellow, densely white pollinose, shining dark brown to blackish in ground color of the vertex and upper two-thirds of parafrontalia. Interfrontal area bare of pollen and yellow-orange in color. Occiput densely yellow pilose except for the row of prominent black postocular setae. Genae, parafacialia, and parafrontalia with thin yellow hairs, except for black setae on upper halves of parafrontalia, also ocellar triangle with black hairs. Frontal bristles extending well on to the parafacialia, distinctly below bases of antennae and diverging on lower portion, in male divided into two short rows of three bristles each on the area of junction of

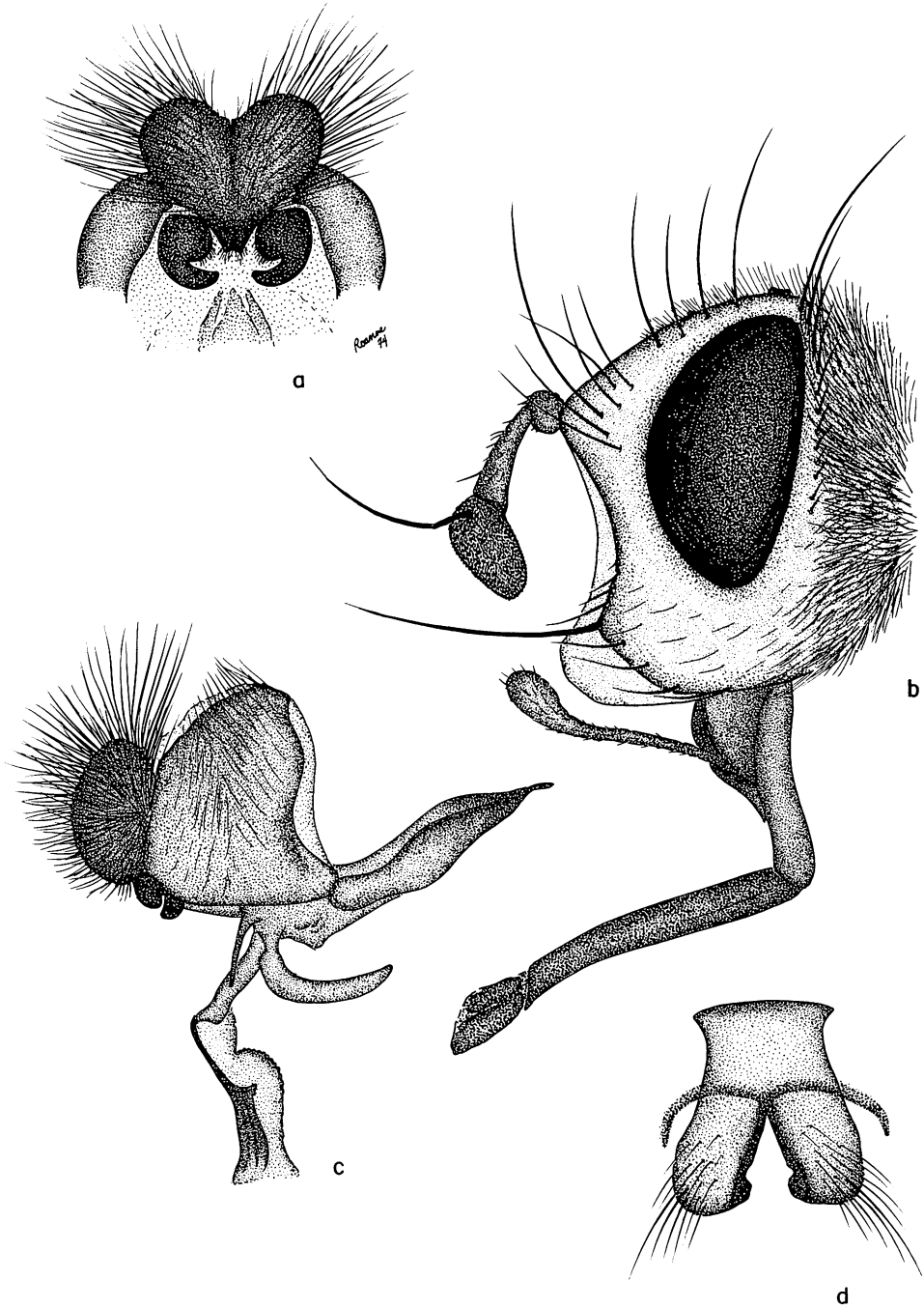


Figure 183—*Archylas cirphis* Curran: a, male genitalia, end view; b, head of male, lateral; c, male genitalia, lateral; d, fifth sternum of male, ventral.

parafrontalia and parafacialia. Female with two pairs of strong proclinate fronto-orbitals and with the frontal row single, not with three pairs of bristles aligned on lower portion as in male. Facial ridge with three strong bristles plus one weak just above the oral vibrissae. Face concave as seen in lateral view. Antennae shaped as in figure 183b. Third segment brown, tinged with rufous, inner basal portion rufous. First and second segments reddish brown. Palpi slender, extending slightly beyond margin of epistoma and enlarged at apices. Rostrum slender, extending well beyond epistoma. Mesonotum submetallic black in ground color, rather densely gray pollinose, with four narrow, indistinct, subopaque black vittae, interrupted at the suture. Five or six strong bristles present on each humerus, and four or five pairs of postsutural dorsocentrals. Prealar bristles comparatively small, usually distinctly smaller than the first postsutural dorsocentral; the size apparently is variable: on some specimens it is nearly as large as the first postsutural dorsocentral, in most it is distinctly smaller. Dorsus of thorax black setose, with yellow hairs on the notopleura, sides of humeri and sides of scutellum. Postalar declivity with fine pale hairs on median portion. Pleura entirely yellow pilose. Sternopleurals 2:1. Two strong stigmatic bristles and two propleurals. Legs subshining black, tinged with rufous on the femora and tibiae, and with posterior surface of front femur densely gray pollinose. Basicostal scale yellow, epaulet orange-yellow. Base of $R_4 + 5$ with about six black setae. Wings infuscated, especially along interior portion, with the upcurved portion of vein $M_1 + 2$ rather strongly concave. Abdomen reddish, tinged with black, and with an indistinct blue-black vitta extending down middle of terga 1-4 and with fifth tergum yellow-brown pollinose as seen in indirect light. Fifth sternum as in figure 183d and male genitalia as in figures 183a and c.

Length: 12.5-14.25 mm. It should be noted that Curran in the original description gave the measurement as 10-12 mm. I have not seen specimens smaller than 12.5 mm.

The adults are commonly found frequenting flowers, especially of Compositae.

Subfamily GONIINAE

Characterized by having setae on sides of prosternum and propleura bare. The prealar bristles are strong, usually as large as first postsutural dorsocentrals; the face is almost always rather oblique in profile and longer than front (fig. 192b); the antennae are situated above the middle of the eyes; the basal excavation of the abdomen reaches to the anterior margin of tergum 1 + 2 and the terga extend nearly, or to the midline on the venter covering over the sternum, the terminalia often hidden inside the fifth tergum. Also, in the tribes represented in Hawaii, with no dark line or fold extending from bend of vein $M_1 + 2$ except in Exoristini. Usually robust species.

The species represented in Hawaii are arranged in seven tribes.

Tribe ANACAMPTOMYIINI

Based on the representative present in Hawaii, this tribe is characterized by having the sterna of the abdomen almost completely covered by the terga; the head distinctly wider than high; two pairs of strong, reclinate fronto-orbitals in both sexes; genae very narrow, measured from eye margin to vibrissal row, about equal to the width of the third antennal segment and female front almost as wide as eyes.

Genus **EUVESPIVORA** Baranov

Euvespivora Baranov, 1964, Vet. Arhiv. Zagreb 12:162. Type-species, *orientalis* Baranov, by original designation.

Xenosturmia Mesnil, 1944, Fliegen Palaeark. Reg. 64g:26. Type-species, *testaceipes* Mesnil, by original designation, = *decipiens* (Walker).

These parasites of vespid wasps are characterized by having the eyes bare; no facial carina; rostrum short and labella large; ocellar bristles small, rather hair-like; frontal row of bristles divergent below, extending onto upper parafacialia to a level slightly beyond apex of second antennal segment (fig. 184a). The three sternopleural bristles are in a line. Scutellum with a pair of lateral bristles on each side, in addition to the stronger regular scutellars. Genae comparatively narrow, about equal in width to parafacialia. Abdominal tergum 1 + 2 lacking marginal bristles. Hind coxae bare above.

Euvespivora decipiens (Walker) (figs. 184a-c)

Eurygaster decipiens Walker, 1859, J. Proc. Linn. Soc. Lond. 3:100. Type-locality: Aru Island.

Euvespivora salomonica Baranov, 1964, Vet. Arhiv. Zagreb 12:163. Type-locality: Solomon Islands.

Xenosturmia testaceipes Mesnil, 1944, Fliegen Palaeark. Reg. 64g:26. Type-locality: Kinigunang, New Britain.

Oahu. First reported June 1972 (Hardy 1975:7). Presently known from only three females from two localities on Oahu.

Immigrant. Moluccas, New Britain, and Solomon Islands.

Bionomics. *E. decipiens* is a parasite of *Polistes* wasp larvae. First instar larvae are deposited at the entrance to wasp nests and these attach to and bore into the host.

Superficially resembling small specimens of *Gonia longipulvilli* (Tothill) because of the mostly rufous abdomen. The two have little else in common and are differentiated by the characters given in the key above.

Moderate-sized species, body, 8.0–8.5 mm., with gray pollinose thorax, yellow legs, and mostly yellow to rufous abdomen. The following diagnostic features are based upon female specimens. Males have not yet been seen in

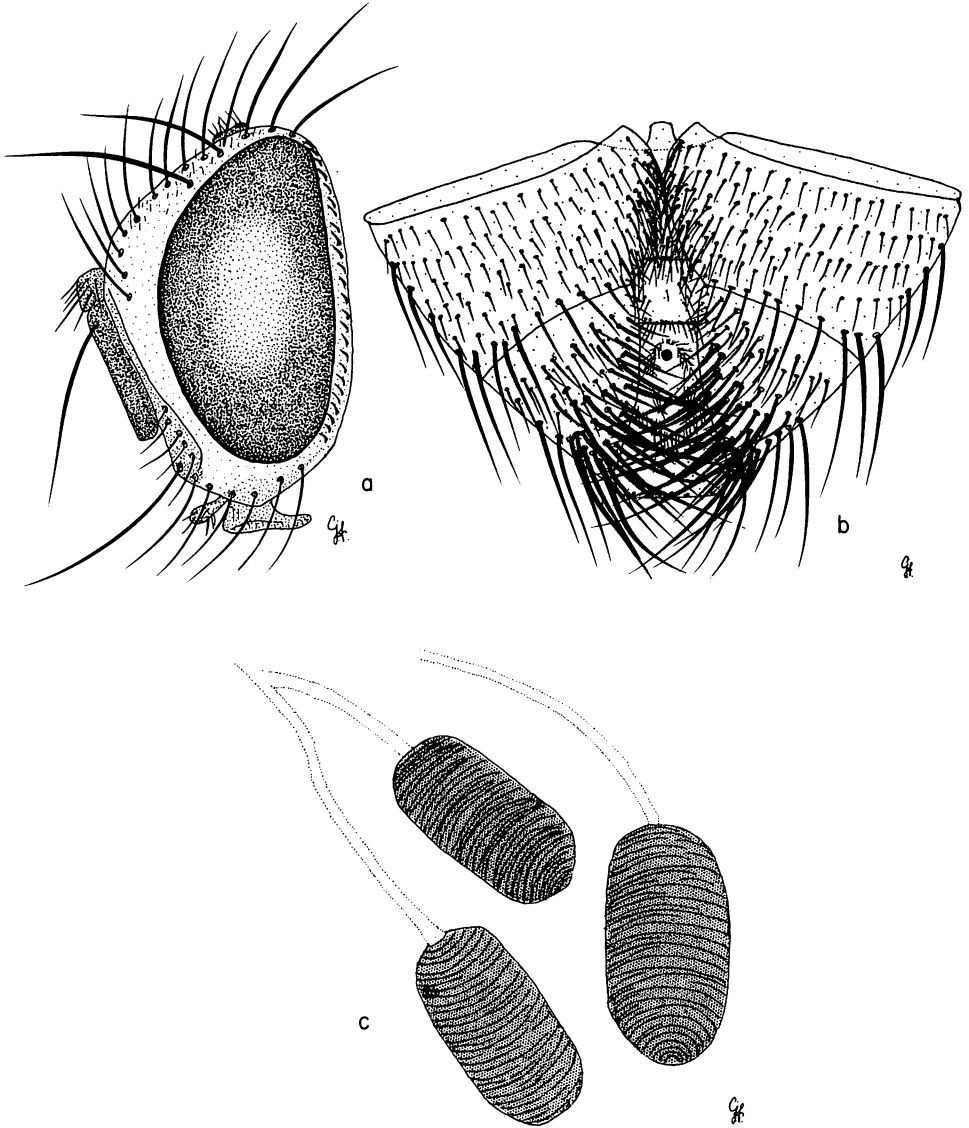


Figure 184—*Euvespivora decipiens* (Walker): a, head of female, lateral; b, apical portion of female abdomen, ventral; c, spermathecae.

Hawaii. Front gently divergent below, narrowest on the upper portion below ocellar triangle, at widest portion almost equal in width to one eye. Parafrontalia densely yellow-gray, median portion of front brownish red. Frontal row of bristles divergent below, extending onto upper parafacialia, to a level about opposite end of second antennal segment. Two pairs of strong, proclinate fron-

tal orbitals (fig. 184a). Antennae mostly rufous, tinged with brown along upper margin and on apical portion of third segment, especially on outer surface. Third segment five times longer than wide, extending almost to lower margin of face (fig. 184a). Face entirely densely gray pollinose. Palpi and mouthparts yellow. Labella equal in length to slightly longer than the rostrum. Occiput densely light pilose, only the occipital row black. Ocellar bristles small, scarcely one-third longer than the setae on the ocellar triangle. Thorax mostly black in ground color with humeri, scutellum, and lateral and posterior margins of mesonotum yellow, densely covered with yellow-gray pollen on the dorsum. With indications of four faint, narrow vittae; the median pair beginning at anterior margin and extending beyond suture to a level between the first two postsutural dorsocentrals and the lateral pair indicated by a narrow, triangular-shaped mark on each side before the suture and a narrow streak behind suture extending from about level with first postsutural dorsocentrals to almost halfway between the third and fourth pair of dorsocentrals. Abdomen rufous, with a narrow black vitta extending full length on the middle of dorsum. Ventral view of female abdomen as in figure 184b. Three barrel-shaped spermathecae (fig. 184c).

Tribe BLONDELIINI

Characterized by having vein $R_4 + 5$ extending to near apex of wing; upbend of $M_1 + 2$ rather strongly oblique to the m crossvein; only three supraalars and three humeral bristles and lobes of male cerci not fused (fig. 185e). Arista gradually tapered to long slender apex.

According to Sabrosky and Arnaud, *in* Stone et al. (1965:1037), members of this tribe parasitize a variety of hosts including larvae of Lepidoptera, Coleoptera, and Tenthredinid wasps.

Genus **EUCELATORIA** Townsend

Eucelatoria Townsend, 1909, Ann. Ent. Soc. Amer. 2:249. Type-species, *Tachina armigera* Coquillett, by original designation.

In the original description, Townsend characterized *Eucelatoria* by having "orbital bristles present in female, absent in male. Eyes bare. Abdomen with discal bristles on intermediate segments in male but without median bristles either marginal or discal on first two segments in female. Median ventral carina present in female, strongly developed, piercing sheath present." No bristles present on apicomedian portion of scutellum between the large apical bristles.

This belongs in the group which inject their eggs or larvae into the body of the host, and the external reproductive apparatus of the female is extensively modified for this purpose. The seventh sternum is developed into a curved, sharply pointed, thorn-like piercer (fig. 185d), which lies along the mid ventral line of lateral margins of terga 3-4; these are strongly carinate and densely

spinose. The piercer is grooved along the middle of the venter and the ovipositor glides along this groove in depositing the eggs or larvae. The piercer first punctures the host integument then the ovipositor is inserted into the wound for deposition of the egg or larvae.

***Eucelatoria armigera* (Coquillett) (figs. 185a-g)**

Tachina armigera Coquillett, 1889, Period. Bul. U.S. Dept. Agric. Div. Ent. 1:332.

On all of the main islands. First reported on Oahu in 1941 (Pemberton 1943).

Immigrant. California to Texas and Mexico, also West Indies.

Bionomics. The female larviposits subcutaneously in the host. This species parasitizes a wide variety of caterpillars. The first recorded specimen in Hawaii was reared from "a lepidopterous larva in a tomato imported from the mainland" (Pemberton 1943). In Hawaii it has been reared from *Spodoptera mauritia* (Boisduval) (Tanada 1958:434) and other armyworms, the coconut leafroller (*Hedylepta blackburni* [Butler]), the corn earworm (*Heliothis zea* [Boddie]), fern caterpillars (*Callopistria* sp.), grass webworm (*Herpetogramma licarsisalis* [Walker]), monarch butterflies (*Danaus plexippus* [Linnaeus]), and others.

This species superficially resembles *Lespesia archipivora* Riley and the two have no doubt often been confused. Bianchi (1964) decided they were synonyms, but this is not correct. Jackson et al. (1969) stated that *Eucelatoria armigera* is probably not present in Hawaii and that the species we have here is probably *E. rubentis* (Coquillett). They based this conclusion upon the recorded host information and apparently not upon actual examination of specimens from Hawaii. Dr. Sabrosky (*in litt.*) has confirmed that "the Hawaiian form is the true *armigera*."

A predominantly gray species with four rather indistinct, black vittae on mesonotum and with apices of terga 2-4 subshining black, and apex of fifth tergum reddish. It is readily differentiated from *Lespesia archipivora* by the much narrower front and face, having only one row of frontal bristles, not two; frontal bristles almost in line with the row of bristles of facial ridge (figs. 185a,b), rather than frontal row divergent on lower part, not in line with facial row (fig. 188b); females with a prominent piercing structure; no bristles or strong setae at apex of scutellum, between the large apical bristles, as well as by other characters as given in key above and in the descriptions.

The head shape and bristling are as in figures 185a,b, the wing as in figure 185c, the fifth sternum and male genitalia as in figures 185e,f, and the details of the female ovipositor and the spines on the lateral margins of the fourth and fifth terga as in figure 185d. The female piercer is three times longer than wide, slender compared to the other two species at hand, and with only two rows of short, thick spines on the inner margins of terga 3 and 4.

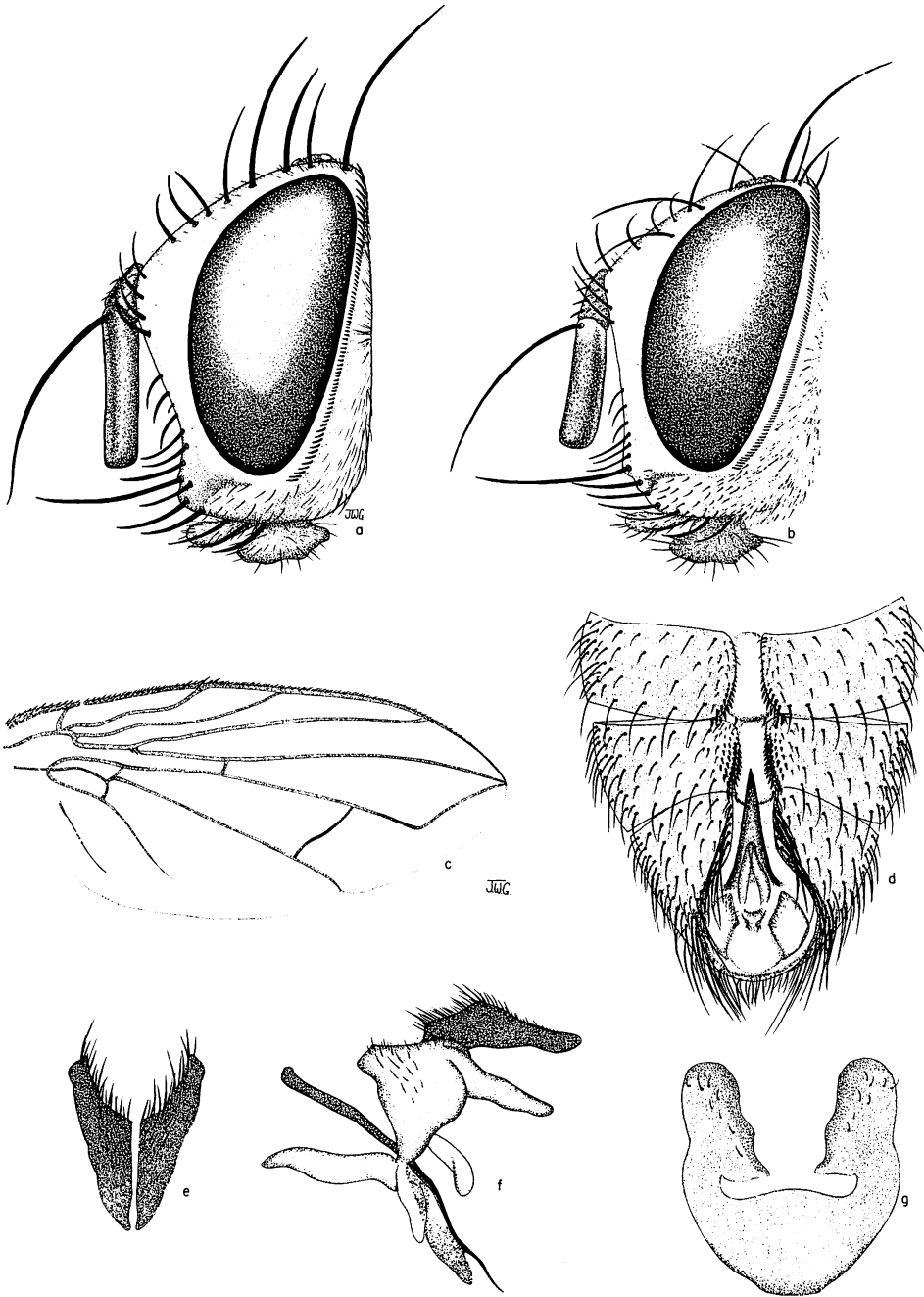


Figure 185—*Eucelatoria armigera* (Coquillett): a, head of male, lateral; b, head of female, lateral; c, wing; d, female abdomen, ventral; e, male genitalia, end view; f, male genitalia, lateral; g, fifth sternum of male.

Sterna three and four each with a pair of strong black spines on apical margins in all three species studied.

Length: body, 4.25–8.4 mm.; average 6.5 mm.

***Eucelatoria* spp.? “Arizona” and “Mexico” (figs. 186a–f)**

Two populations have been purposely introduced into Hawaii, as biological control agents, from Tuscon, Arizona, and Oaxaca, Mexico. The “Arizona”

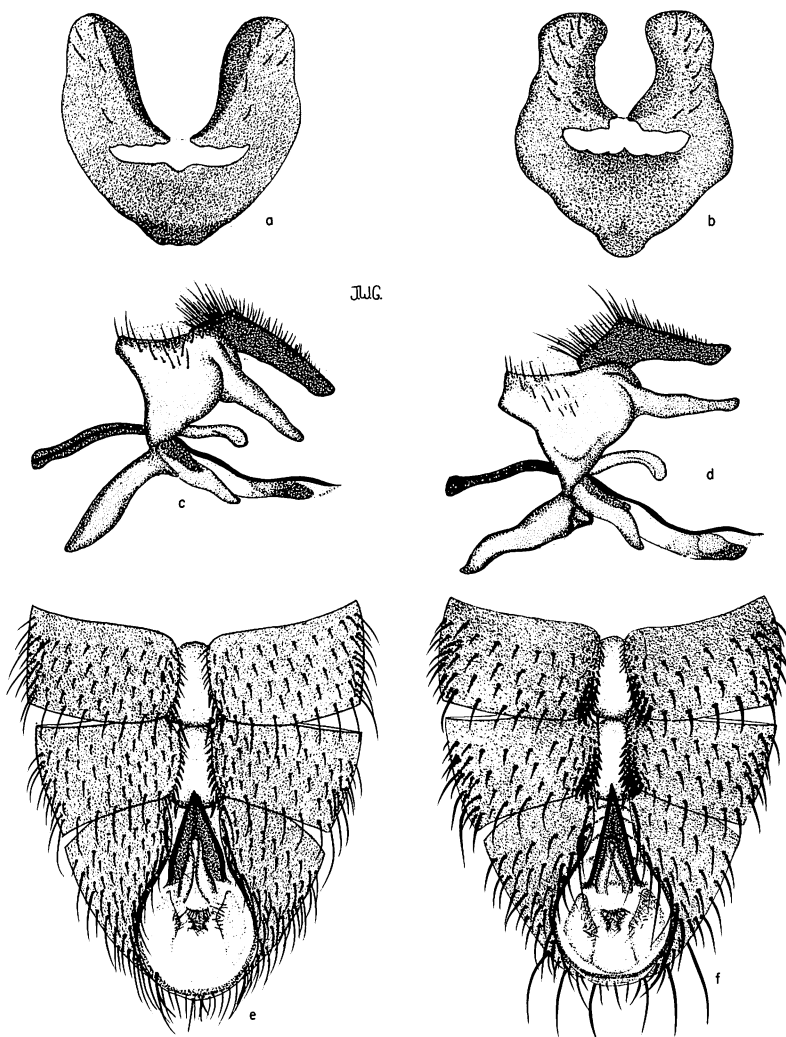


Figure 186—*Eucelatoria* sp.? “Arizona”: a, fifth sternum of male; c, male genitalia, lateral; e, female abdomen, ventral. *Eucelatoria* sp.? “Mexico”: b, fifth sternum of male; d, male genitalia, lateral; f, female abdomen, ventral.

population was released on all of the major islands except Lanai, November-December 1971 (Davis 1972:188), for control of the corn earworm (*Heliothis zea* [Boddie]). The "Mexico" population was released on all the main islands except Molokai and Lanai, April 1974 (Nakao and Funasaki 1976:331) for control of the monkeypod-kiawe moth (*Melipotis indomita* [Walker]) and has been recovered on Oahu (Mau 1977).

These populations have been studied by Dr. C. F. Sabrosky (USDA, U.S. National Museum), but the taxonomy has not yet been worked out and the species cannot be placed. These are not definitely known to be established. Specimens which may represent the Mexican species were reared from *Melipotis* larvae, Hickam Field, Honolulu, Oahu, April 1975.

Both of these fit the general characteristics of *armigera* and I find no morphological characters for differentiating them except in the development of spines on the lateral margins of the third and fourth terga of the female and in the ovipositor shapes (figs. 185d, 186e,f); also the shape and development of the fifth sternum of the male seems of diagnostic importance (figs. 185g, 186a,b).

The "Arizona" species is consistently smaller, individuals average 5.0-5.5 mm. in length, the cerci of the male appear more evenly tapered on the outside margins, the surstyli more evenly tapered to the apex, the parameres less bowed, and the shape of the fifth sternum and configuration of the membranous area in middle of sternum seem distinctive (figs. 186a and c). The piercer of the female is very similar to that of the "Mexico" species, being comparatively short and broad, slightly less than two times longer than wide. The most characteristic feature of this species is the presence of only one row of strong spines on the inner margins of terga 3 and 4 (fig. 186e).

The population from Mexico is very similar to *armigera* in size and morphological characteristics. The male fifth sternum and genitalia are as in figures 186b and d. The females are differentiated by having a short, broad piercer, similar to that of "Arizona" but having very numerous, densely placed, short, thick spines on the inner margins of terga 3 and 4, these are arranged in three distinct rows and four indistinct rows (fig. 186f).

Genus **LIXOPHAGA** Townsend

Lixophaga Townsend, 1908, Smithsn. Inst., Smithsn. Misc. Collect. 51(2):86.

Type-species, *parva* Townsend, by original designation.

For synonymy refer to Sabrosky and Arnaud, *in* Stone et al. (1965:1043).

Characterized by having two strong, proclinate, fronto-orbitals in both sexes; cell R_5 ending at or very near apex of wing; the section of vein $M_1 + 2$ from m crossvein to bend is about equal to that portion from bend to wing margin (fig. 187a); only three pairs postsutural dorsocentrals, 2-4 hypopleural bristles and only one median posterior bristle on front tibia. In combination with the parafacialia and facial ridges bare, except for a few black setae on lower edge above vibrissae (fig. 187c); vibrissae end opposite epistomal

margin; eyes bare; aristaе pubescent; outer vertical bristles about half as long as inner; posterior pair of presutural acrostichal bristles situated very close to the suture and much behind the posterior pair of presutural dorsocentrals; also apical scutellars small and cruciate. The mouthparts are rather short, the mentum not much over half as long as palpi. Labella large, nearly equal in length to lower margin of head and when expanded filling the entire oral cavity.

***Lixophaga sphenophori* (Villeneuve) (figs. 187a-d,g,i,k-m)**

The New Guinea Sugarcane Borer

Ceromasia sphenophori Villeneuve, 1911, Wien. Ent. Z. 30:81.

Throughout the islands wherever sugarcane is present: Kauai, Oahu, Maui, Molokai, and Hawaii. Introduced by Muir 1910 (Illingworth 1914).

Immigrant. New Guinea. Purposely introduced into Australia, Fiji, and Hawaii for control of the sugarcane borer (*Rhabdoscelus obscura* Boisduval). In the earlier Hawaiian literature it was cited under *Microceromasia* Villeneuve, it was corrected by Crosskey (Chong 1969).

Bionomics. A parasite of the larvae of *Rhabdoscelus*. The female deposits newly hatched larvae or eggs ready to hatch at the entrance to the tunnels in the sugarcane stalks made by the weevil grubs. For ecological and biological data refer to Muir and Swezey (1916:17), Williams (1931:295), Leeper (1974), Waggy and Beardsley (1974), and Olson (1970 and 1971).

L. sphenophori apparently is a lowland species in New Guinea, the type locality was Laloki River, near Port Moresby. This is the area from which the original material released in Hawaii was collected.

Rather small, entirely black except for the yellow palpi and rufous labella; body ranging from 4.0–6.25 mm., averaging near 6.0 mm.

The only apparently reliable characters I have found for separating the adults is that in *sphenophori* the scutellum is largely subopaque-subshining brown to blackish pollinose with gray pollen only at the apex; the gray mostly confined to area between the large apical bristles and not extending over more than apical one-third of scutellum. In *beardsleyi* n. sp., the apical three-fifths to two-thirds of scutellum is distinctly gray, contrasting from the black basal portion. Also, the pollinosity of the mesonotum and scutellum is typically gray, lacking a distinct golden sheen, and the parafacialia are gray with a faint tinge of golden on upper portion and on vertex. In *beardsleyi*, the mesonotum and scutellum have a golden or yellow cast in the gray and the parafacialia are often mostly faint yellow-gray. Parafacialia at midpoint slightly narrower than third antennal segment, rather than being slightly wider than third antennal segment as in *beardsleyi*. I am unable to find any distinctive features in the genitalia except that the hypandrium in *sphenophori* seems to be distinctly longer and the anterior end more rounded (fig. 187b); the length measures 0.342 mm. and the width 0.219 mm., or 1.57 times longer than wide. In *beardsleyi* the hypandrium is shorter, more pointed apically (fig. 187f), measuring 0.309 mm. in length by 0.264 mm. in width, or 1.18 longer than wide.

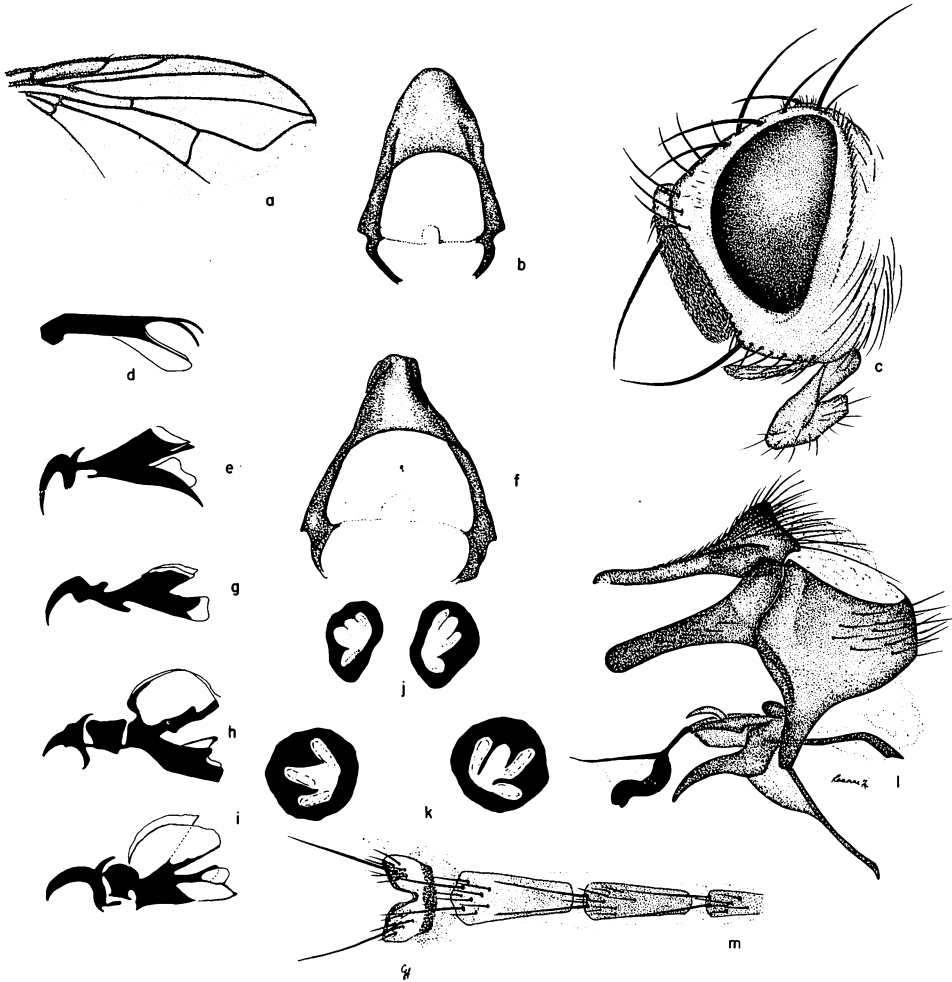


Figure 187—*Lixophaga sphenophori* (Villeneuve): a, wing; b, male hypandrium; c, head; d, cephalopharyngeal skeleton of 1st instar larva; g, cephalopharyngeal skeleton of 2nd instar; i, cephalopharyngeal skeleton of 3rd instar; k, posterior spiracles; l, male genitalia, lateral; m, sternum 2-5, male. *L. beardsleyi* n. sp.: e, cephalopharyngeal skeleton of 2nd instar; f, hypandrium of male; h, cephalopharyngeal skeleton, 3rd instar; j, posterior spiracles. (Figures d, e, g, h, i, j, and k copied from Waggy and Beardsley 1974: 491-492).

The two species can readily be differentiated on the basis of larval morphology: the shapes of the mouthhooks and cephalopharyngeal skeletons are characteristic (figs. 187e,g-i), as are the shapes and positioning of the posterior spiracles (figs. 187j-k). The mouthhooks of *sphenophori* are longer (in third instar 0.24 mm. in length), the apical portion is rather thin compared to the ventral posterior process (fig. 187i). In *beardsleyi*, the third instar mouthhooks are shorter, (0.16 mm.) with the apical portion equal to or broader than the ven-

tral posterior projection (fig. 187h). In *sphenophori*, the posterior spiracles are circular and average 0.19 mm. in diameter, and the distance between the stigmata averages 0.146 mm. In *beardsleyi*, the spiracles are elongate, slightly kidney-shaped, are approximately 0.16 mm. wide and 0.25 mm. in their dorsoventral measurement, and the distance between the stigmata averages 0.065 mm. The proximity of the stigmata is the most easily seen character for separating these (figs. 187j and 187k).

In addition to the above, head shaped as in figure 187c with front receding and the large bristle of the vibrissal row situated opposite the epistomal margin. Frontal row of bristles extending to a level approximately opposite end of second antennal segment. Sides of front gently convergent dorsally, in median portion front nearly equal in width to one eye. The interfrontal area is broad, opaque, brown to blackish, tinged with red, and nearly two times wider than parafacialia. Third antennal segment three to four times longer than wide; arista short, pubescent at base. Occiput with scattered, black setae behind postocular row on upper median portion, otherwise pale yellow setose. Genae with scattered black setae over anterior two-thirds. Mouthparts short, mentum about two-thirds as long as palpi, the latter almost straight-sided, scarcely enlarged apically. Metanotum gray with four subopaque black, longitudinal vittae. Three humeral bristles. Three presutural and three postsutural dorsocentrals and acrostichals and also three postsutural supraalars. The posterior presutural acrostichals situated near suture, much behind the posterior presutural dorsocentrals. First postsutural supraalars strong. Pteropleurals small, compared to the sternopleurals, less than half the length of the upper pair. Three sternopleurals with the median (smaller) bristle situated diagonally below the first bristle. Two to four hypopleurals, averaging three. Claws and pulvilli short, much shorter than fifth tarsomere. Wings mostly subhyaline with a distinct brown tinge along anterior portion. With two or three rather strong setae at base of vein $R_4 + 5$ on upper side. Venation as in figure 187a. Costal scale and epaulet dark brown to black and tegula yellow, covered with dense yellow pubescence. Abdomen subshining black with prominent gray crossbands at bases of terga 3 to 5. Fifth sternum as in figure 187m; male genitalia as in figure 187l.

***Lixophaga beardsleyi* Hardy new species (figs. 187e,f,h,j)**

Fitting very near *sphenophori* and originally confused with that species. F. A. Bianchi, the collector who sent the "strains" from Wau and Garaina, New Guinea, first pointed out that under field conditions these appear to be different. It was clearly demonstrated by J. W. Beardsley and student assistants that these were distinct species and were incapable of interbreeding with the form which had originally been sent in from Laloki River and which is well established in the Hawaiian Islands.

Differing from *sphenophori* as discussed under that species and as shown in figures 187e-m.

This species apparently occurs at higher elevations; most of the collections were made in the Wau area at elevations from 4,000–6,000 ft. Also from Garaina, ca. 2,500 ft. This species apparently does not occur in the lowlands of New Guinea. The populations collected at Wau and Garaina would cross readily in the laboratory, they are not interfertile. These populations, however, would not cross with *sphenophori*. Populations from Wau and Garaina, New Guinea, were introduced between April and November 1968 and propagated in the laboratory. Several thousand specimens were released in sugarcane fields on Kauai and Hawaii (Davis and Chong 1969:319).

It is not known to be established in Hawaii; numerous liberations have been made but it has not yet been recovered in the field. Since it is, however, so very close to *sphenophori* it could easily be overlooked and the possibility of it becoming established cannot yet be ruled out.

Tribe ERYCIINI

Characterized by having a row of black setae on the occiput behind the postocular row; the bend in vein $M_1 + 2$ nearer to m crossvein than to end of vein; bristles of frontal row hair-like or absent on upper portion and a pair of strong reclinate superior fronto-orbitals are situated almost in line with the frontal row (fig. 188c). The prealar bristle is well developed, about equal in size to first postsutural dorsocentral. In the genus on hand the facial ridge is strongly bristled (fig. 188b). The face is carinate and the eyes bare.

Mostly parasites of a wide variety of lepidopterous larvae with a few species parasitic on saw fly larvae.

Genus **LESPESIA** Robineau-Desvoidy

Lespesia Robineau-Desvoidy, 1863, Hist. nat. des Dipt. des environs de Paris 1:567. Type-species, *Erycia ciliata* Macquart, by monotypy.

For synonymy refer to Sabrosky and Arnaud, in Stone et al. (1965:1101).

Mostly black, rather densely gray pollinose flies. Four black vittae down mesonotum. Characterized by having four humeral and four sternopleural bristles; two pairs of reclinate fronto-orbitals which are nearly in line with the frontal row of bristles in both sexes, and female also with two pairs of proclinate fronto-orbitals; ocellar bristles strong, proclinate; eyes bare; parafacials bare below the frontal row of bristles; with a strong facial carina and facial ridges strongly bristled to about two-thirds the distance to bases of antennae (fig. 188b); apical scutellars strong, erect, and cruciate; vein $R_4 + 5$ with only two or three setae at the base; mentum very short, one-half to three-fifths as long as the palpi. Lobes of cerci separated, long, slender, parallel-sided as seen in end view (fig. 188e); surstyli well developed (fig. 188d).

Bionomics. The females deposit mature eggs, ready to hatch, on the bodies of Lepidopterous larvae.

Beneway (1963) allies it with the genera *Eufrontina* Brooks and *Frontiniella* Townsend and differentiates it by having four sternopleural bristles, not three; by the differently shaped male genitalia; and by having the stigmal plates of the puparium flush with the surface, rather than protruded, forming tubercles.

For a revision of North American species refer to Beneway (1963).

***Lespesia archippivora* (Riley) (figs. 188a-e)**

Tachina archippivora Riley, 1871, Ann. Rpt. (1870) Mo. State Bd. Agr. 6:150.

This name has been commonly credited to Williston (1889) and has been in the Hawaiian literature under *Frontina* Meigen and *Achaetoneura* Brauer and Bergenstamm.

For synonymy refer to Sabrosky and Arnaud, *in* Stone et al. (1965:1101).

Widespread over the islands including the Northwestern Hawaiian Islands. Brought in for biological control of cutworms by Koebele about 1898. First reported by Swezey (1907).

Immigrant. Nearctic region and Mexico.

Bionomics. An important parasite of cutworms, armyworms, leafrollers and other moths, and also butterfly caterpillars; it accounts for nearly 100 percent of the parasitism of the lawn armyworm, *Spodoptera mauritia acronyctoides* (Signoret), and is the most common parasite of monarch butterflies. The female deposits membranous (very thin chorion) eggs, ready to hatch, on the body of the host larva. For biological data refer to Swezey (1907:47) and to Etchegary (1973). Beardsley (1964) reared an immigrant encyrtid wasp (*Exoristobia philippinensis* Ashmead) from puparia of this species.

A comparatively small species, body, 5.0-7.5 mm., averaging 6.75 mm. Differentiated from related species of *Lespesia* by having the pulvilli of front legs shorter than the last tarsomere; abdomen uniformly gray pollinose, without shining black bands on posterior margins of terga 3-5; middle tibiae with one strong anterodorsal bristle at middle of segment which extends almost to apex; scutellum with three lateral bristles; median marginal bristles present on abdominal tergum 3 and abdomen black in ground color, predominantly gray pollinose without bare red areas except for some small red spots laterally on third tergum. Male genitalia as in figures 188d,e.

In addition to the above characters, head as in figures 188b,c. Antennae of male black except for tinge of rufous on second segment, in female with third segment broadly rufous on basal half and on under side. Third segment elongate, especially in male, in latter extending almost to oral margin. Basal portion of arista thickened, strongly tapered apically. Frontal row of bristles extending on parafacials to just beyond base of third antennal segment. Basal ridges bristled over about two-thirds of their length. Palpi yellow, with moderately long ventral setae on apical half and mouthparts mostly black, tinged with rufous on labella, shaped as in figure 188b. Fifth sternum of male as in figure 188a.

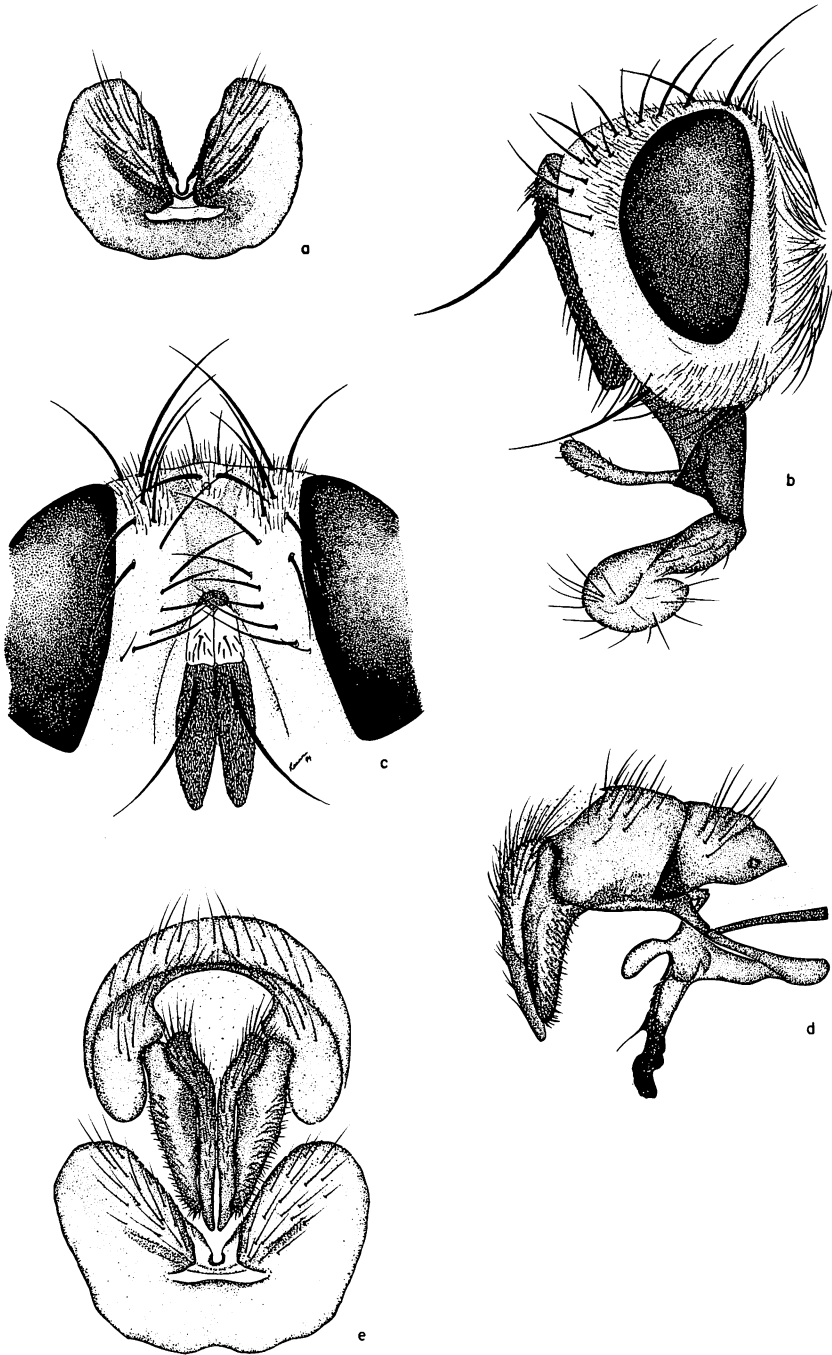


Figure 188—*Lespesia archippivora* (Riley): a, fifth sternum of male; b, head of male, lateral; c, front of head, female; d, male genitalia, lateral; e, male genitalia, end view.

Tribe EXORISTINI

Characterized by having the bend of vein $M_1 + 2$ abrupt, bent up at a right angle and prolonged by a darkened fold or indistinct appendage (fig. 189c). Vein R_5 ending well before wing apex; the upbend of $M_1 + 2$ almost parallel with the m crossvein. Four supraalar bristles, two large and two small; four humeral bristles; and lobes of male cerci fused (fig. 189d).

Mostly parasites of larvae of Lepidoptera and of tenthredinid wasps.

Genus **EXORISTA** Meigen

Exorista Meigen, 1803, Mag. f. Insektenk. 2:280. Type-species, *Musca larvarum* Linnaeus, by monotypy.

For synonymy refer to Sabrosky and Arnaud, in Stone et al. (1965:1054) and to Crosskey, in Delfinado and Hardy (1977:656).

The members of this genus are characterized by having the occiput entirely white haired, except for the occipital row of setae; face with a strong median keel; m crossvein situated about two-thirds the distance from r-m crossvein to the bend of $M_1 + 2$; $M_1 + 2$ bent sharply upward at a right angle and with a distinct dark line or fold extending from bend (fig. 189c); frontal row of bristles extending onto parafacialia to about opposite middle of third antennal segment (fig. 189e); ocellar bristles very strong, proclinate, equal in size to most of the frontal bristles and the largest of the bristles of the vibrissal row situated just above margin of epistoma.

Subgenus **PODOTACHINA** Brauer and Bergenstamm

Podotachina Brauer and Bergenstamm, 1891, Denkschr. Akad. Wiss. Wien 58(1):350. Type-species, *Exorista sorbillans* Wiedemann, by designation of Townsend 1916:8.

This subgenus is characterized by having 3 + 4 dorsocentral bristles; male cerci densely yellow haired; ocellar bristles opposite the median ocellus; labella large, nearly as long as mentum; third antennal segment about three times longer than second and arista thickened on basal half; also all tibia with two lines of short, very closely placed setae, with a bare silvery gray pollinose space between, extending full length of segment on dorsal surface.

Exorista sorbillans (Wiedemann) (figs. 189a-e)

Tachina sorbillans Wiedemann, 1830, Aussereurop. Zweifl. Insekt. 2:311.
Type-locality: Canary Islands.

For synonymy refer to Mesnil (1960:578) and to Crosskey, in Delfinado and Hardy (1977:659).

Oahu. Introduced and liberated August 1971, from Thailand, for biological control of the citrus swallowtail butterfly, *Papilio xuthus* (Linnaeus) (refer to Davis 1972:188). Not known to be established.

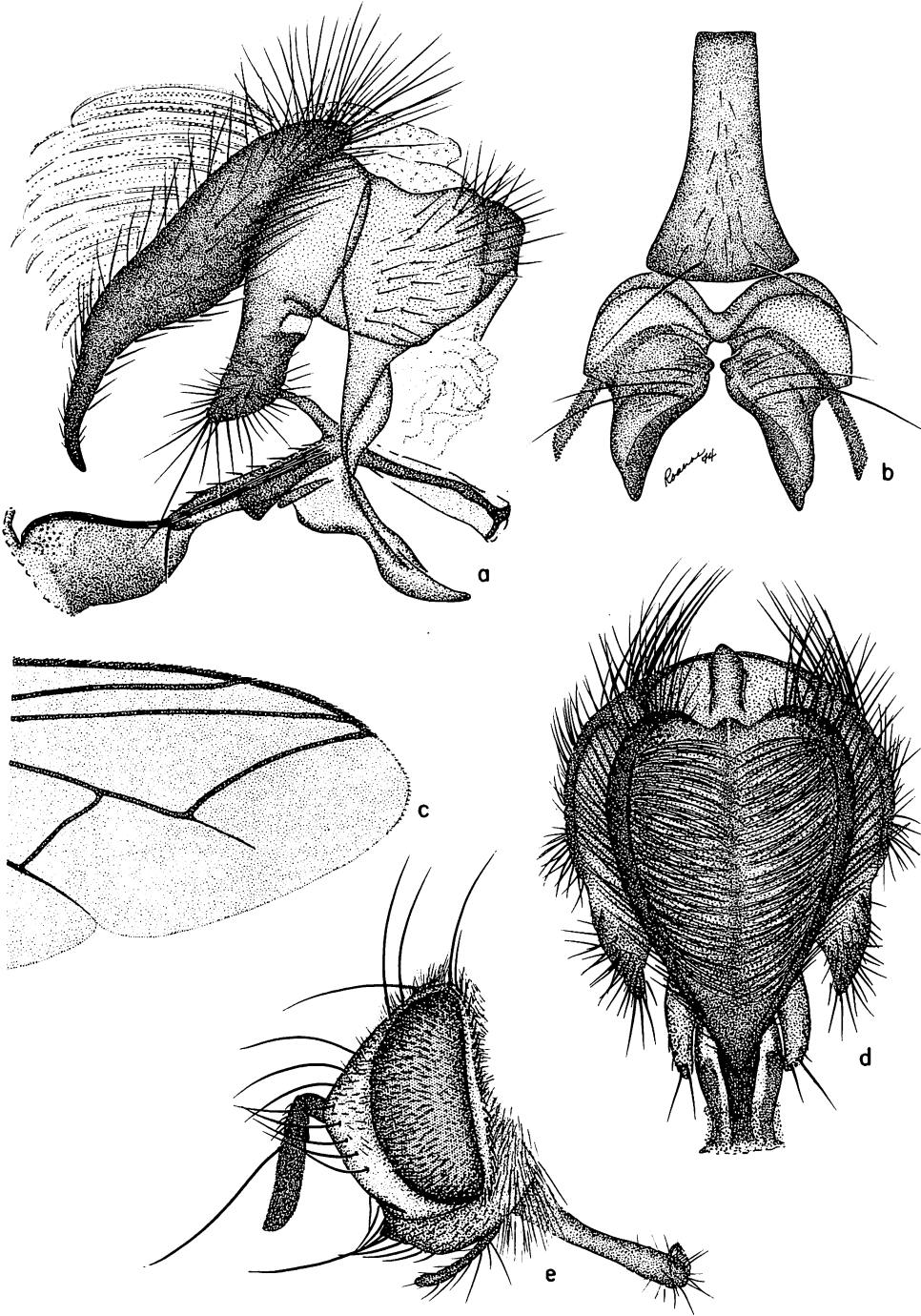


Figure 189—*Exorista sorbillans* (Wiedemann): a, male genitalia, lateral; b, fourth and fifth sterna of male, ventral; c, apical portion of wing; d, male genitalia, end view; e, head of male, lateral.

Immigrant. Widespread over Oriental, southern Palaearctic and Ethiopian regions; also Japan, New Guinea, and Australia.

Bionomics. Parasitizes a wide range of Lepidoptera, refer to Mesnil (*op. cit.*, p. 580) for recorded hosts, also to Van Emden (1954:72). The latter records it having been bred from species of the following families: Nymphalidae, Sphingidae, Lymantriidae, Lasiocampidae, Saturniidae, Arctiidae, Agrotidae, Geometridae, Hesperidae, Limacodidae, Drepanidae, Psychidae, Amathusiidae, and Bombycidae (including *Bombyx mori* Linnaeus).

Differentiated from other tachinids in Hawaii by the subgeneric, generic, and tribal characters given above. In my key it comes out in the same couplet with *Euvespivora decipiens* (Walker), but these fit in different tribes and are readily separated by the key characters. Mesnil (1960:563) keys *sorbillans* near *flavicans* Mesnil, from the Belgian Congo, and differentiates it by having only two anterodorsal bristles on middle tibia, not three; second costal section of wing much shorter than the third, not about equal in length to third; cerci of male long triangular, not broad, heart-shaped.

Entirely black flies, with the head and body mostly gray to silvery pollinose, with the parafrontalia opaque black, four dull black vittae down mesonotum, first tergum of abdomen dull black and other terga broadly subshining black, covered with brownish pollen on apical portions. Head shaped as in figure 189e with the frontal row of bristles in the male extending well below middle of face and beyond middle of third antennal segment. Five bristles present on parafrontalia, below level of bases of antennae (fig. 189e). At narrowest point the male frons is about one-fourth the width of the head. Parafrontalia of male rather densely covered with fine hairs, these extend onto the parafrontalia below level with base of antennae. In female the frontal row extends to about middle of face, or about middle of third antennal segment and consists of three strong bristles below bases of antennae. Also the parafrontalia are more sparsely haired in the female and two strong proclinate fronto-orbital bristles are present. Third antennal segment at least two times longer than second, four times longer than wide in male, and about three times longer than wide in female. Palpi varying from mostly rufous to brown, tinged with rufous. Mouthparts mostly dark brown. Labella about equal in length to mentum. It should be noted that Mesnil (1960:563) and Van Emden (1954:72) cite two anterodorsal bristles on middle tibiae as being a diagnostic character for this species. Of the four specimens on hand one female has only two anterodorsals on middle tibia, the other three specimens, two females, one male have three rather well developed anterodorsals arranged near middle of segment. This may be a variable character. Only one strong stigmatic bristle plus two fine hair-like bristles on the anteroventral portion of the mesopleuron. One strong propleural plus one hair-like bristle. Sternopleurals 2:1. The basal portion of vein $R_4 + 5$ setose to about half way to r-m crossvein. Abdomen of male with an indistinct longitudinal black vitta extending over median portion of terga 3-5. Second and third terga each with a pair of median bristles on posterior margin. Tergum 4 with a row of strong bristles along hind margin and tergum 5 with

two incomplete rows of bristles across the apical, subshining black portion. The fourth sternum is broadened on the posterior end, narrowed anteriorly, the posterior border about two times wider than anterior. The fifth sternum is shaped as in figure 189b. As seen in end view the male cerci are as in figure 189d, the lobes are completely fused on the apical portions, divided basally with the sides densely covered with long incurved hair. As seen from lateral view the genitalia is as in figure 189a, the surstyli are moderately developed.

The specimens on hand measure 9.0–10.0 mm. Mesnil (*loc. cit.*) gave the measurement as 9–12 mm. and Van Emden (*loc. cit.*) as 9–14 mm.

Tribe GONIINI

As represented by the genera present in Hawaii, this tribe is differentiated by having the front very broad, often inflated, and with one row of bristles in addition to the frontal row or with numerous bristles scattered over the front (figs. 190c and 191b); notopleuron with a third smaller bristle between and slightly outward of the normal two bristles; arista broad, often elbowed, second joint elongate, abdominal terga covering sterna, fifth tergum enclosing genitalia; four sternopleural bristles, almost in line; eyes bare; face slightly carinate, three or four humeral bristles, three in a row and legs strongly bristled.

These flies parasitize a large variety of lepidopterous larvae, especially cutworms and armyworms.

Subtribe GONIINA

Differ from Chaetogaediina by having ocellar bristles reclinate not proclinate (fig. 190c).

Genus **GONIA** Meigen

Salmacia Meigen, 1800, Nouv. Class. des mouches a deux ailes p. 38. Type-species, *Musca capitata* DeGeer, by subsequent designation (Coquillett 1910:602. Suppressed by I. C. Z. N. 1963:339).

Gonia Meigen, 1803, Mag. f. Insektenk. 2:280. Type-species, *bimaculata* Wiedemann, by subsequent designation (Sabrosky and Arnaud, *in* Stone et al. 1965:1075).

For synonymy refer to Sabrosky and Arnaud, *in* Stone et al. (*loc. cit.*).

Characterized by the broad front and parafacialia, with the front slightly inflated and waxy in appearance. The parafrontalia about three times wider than the interfrontal area and with numerous scattered bristles, not arranged in rows (fig. 190c). At narrowest point the front is two-thirds or more the width of the head. Two pairs of proclinate, fronto-orbital bristles present in both sexes. Ocellar bristles large, reclinate. Parafacialia thickly covered with short setae and with a row of rather prominent bristles on inner margin just above facial ridges. Facial ridges bare except for a few black setae on extreme lower portion

near the vibrissae. Face strongly excavated, almost hiding antennae. Third antennal segment elongate especially in males; female four times longer than wide, in males five to nearly six times longer than wide and in the latter extending almost to lower margin of facial excavation. Aristae short, thick, elbowed, with the second joint elongate, subequal in length to or slightly longer than the last joint (fig. 190c).

Apical scutellar bristles parallel and situated approximately in line with the secondary scutellars. Abdominal terga completely covering the sterna, with the fifth tergum enclosing the genitalia. There is very little noticeable sexual dimorphism, except for the larger, more elongate third antennal segment of the male. Also, the females tend to have more black on the abdomen, with the central vitta broader and the fourth tergum largely black, rather narrowly rufous on posterior lateral margins and on venter (the latter pertains to *longipulvilli*).

For a revision of Nearctic species refer to Tothill (1924).

***Gonia longipulvilli* Tothill (figs. 190a-d)**

Gonia longipulvilli Tothill, 1924, Canad. Ent. 56:211.

Oahu, Molokai, Maui, Hawaii; probably on other main islands. First reported by Arnaud (1957), as *Salmacia*, but records in collections date to 1929.

Immigrant. Western Canada and North America and Mexico.

Bionomics. In Hawaii it occurs mostly at higher elevations ca. 3,000–9,400 ft. It is the most common species in many of the higher mountain areas and probably parasitizes *Agrotis ipsilon* (Hufnagel) and other noctuids. The females deposit eggs on vegetation and these are eaten by their host.

It evidently has been confused in Hawaii with *Chaetogaedia monticola* (Bigot); the two are similar in size and appearance. *G. longipulvilli* is readily differentiated by having the facial ridges bare, except for a few setae above vibrissae (fig. 190c), not bristled (fig. 191b); the ocellar bristles strong, reclinate not proclinate; the second joint of arista more elongate; only three humeral bristles; abdomen predominantly rufous on sides and other details as noted under the generic discussion above.

Head entirely yellow in ground color, except for the compound eyes and except for the median portion of the occiput. Rather densely gray-white pollinose with the front subshining, rather waxy in appearance, appearing somewhat inflated and approximately 2/3 as wide as head; also eye orbits parallel, with the front and face of equal width, except for a very slight narrowing at vertex. Head shape and bristling, antennae, palpi, and mouthparts as in figure 190c. First two antennal segments largely yellow to rufous, third segment black, densely gray pollinose. Palpi entirely yellow, mentum subshining black, about equal in length to lower margin of head. Labella small, (fig. 190c), tinged with rufous. Mesonotum mostly black in ground color, gray pollinose with four indistinct black vittae; posteromedian and narrow lateral margins of mesonotum, also humeri except for a small dark spot on anteromedian portion, also all of the scutellum, except for a very narrow black line across base, yellow.

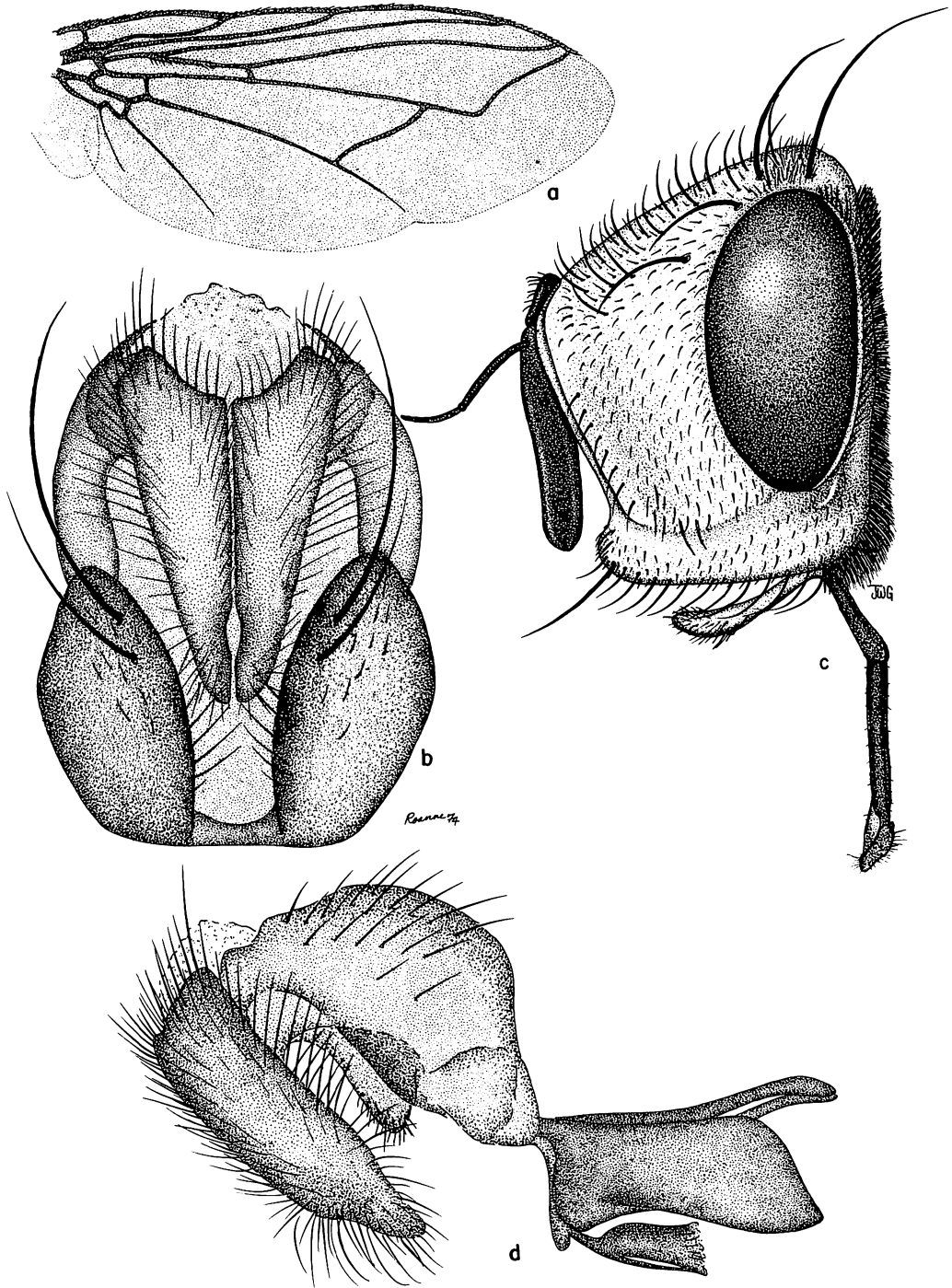


Figure 190—*Gonia longipulvilli* Tothill: a, wing; b, male genitalia, end view; c, head of male, lateral; d, male genitalia, lateral.

Four pairs postsutural dorsocentral bristles. Prealar bristles strong, equal in size to first pair of postsutural dorsocentrals. Pteropleural bristles strong, equal in size to sternopleurals. Four sternopleurals present, three in line and one slightly displaced ventrally. Anteroventral portion of mesopleuron with one strong, plus a number of hair-like bristles (stigmatic area). Pulvilli large, equal or longer than last tarsomere. Wings with the setae at base of vein $R_4 + 5$ extending about half the distance to r-m crossvein. Basicostal scale and epaulet yellow. Bend of vein $M_1 + 2$ comparatively near the m crossvein so the up-curved portion is over two times longer than the straight section of the vein beyond the m crossvein (fig. 190a). Abdomen mostly rufous, in male with a rather narrow black vitta extending from base to fifth tergum, with the fifth entirely black except for narrow basolateral margins, and with silvery gray tomentum (pollen) over most of the fifth tergum, also along basal margins of third and fourth terga. Females with more black on the abdomen, with the median vitta broader and the fourth tergum mostly black. Male genitalia as in figures 190b,d.

Length: body, 8.5–13.0 mm., averaging approximately 12.0 mm.

Subtribe CHAETOGAEDIINA

Differs from Goniina by having ocellar bristles proclinate, not reclinate (fig. 191b).

Genus CHAETOGAEDIA Brauer and Bergenstamm

Chaetogaedia Brauer and Bergenstamm, 1891, K. Akad. der Wiss. Wien, Math.-Nat. Cl. Denkschr. 58:336. Type-species, *Prospheysa vilis* van der Wulp, by subsequent designation (Townsend 1908:94).

For synonymy refer to Sabrosky and Arnaud, *in* Stone et al. (1965:1078).

Resembling *Pseudogonia* Brauer and Bergenstamm but differentiated by having a row of strong bristles on facial ridge; having the ocellar bristles rather weak and proclinate; third antennal segment rounded at apex (fig. 191b); the basicostal scale and epaulet black; upturned section of vein $M_1 + 2$ straight and distance from bend in vein to m crossvein shorter than distance to wing margin; last section of vein $M_3 + 4$ extending as a black line almost to wing margin; second bristle of sternopleural row displaced, lower than the others; male cerci shorter, less slender than *Pseudogonia*, not so closely approximated on apical portions (fig. 191a) and surstyli much larger, better developed (fig. 191c).

Chaetogaedia monticola (Bigot) (figs. 191a–c)

Blepharipeza monticola Bigot, 1887, Ann. Soc. Ent. de France, ser. 6, 7 (Bul.):cxl; also 1888, Ann. Soc. Ent. de France, ser. 6, 8:91.

Widespread over the islands. First recorded by Bigot (1888, *loc. cit.*). Immigrant. Western North America, California to Texas.

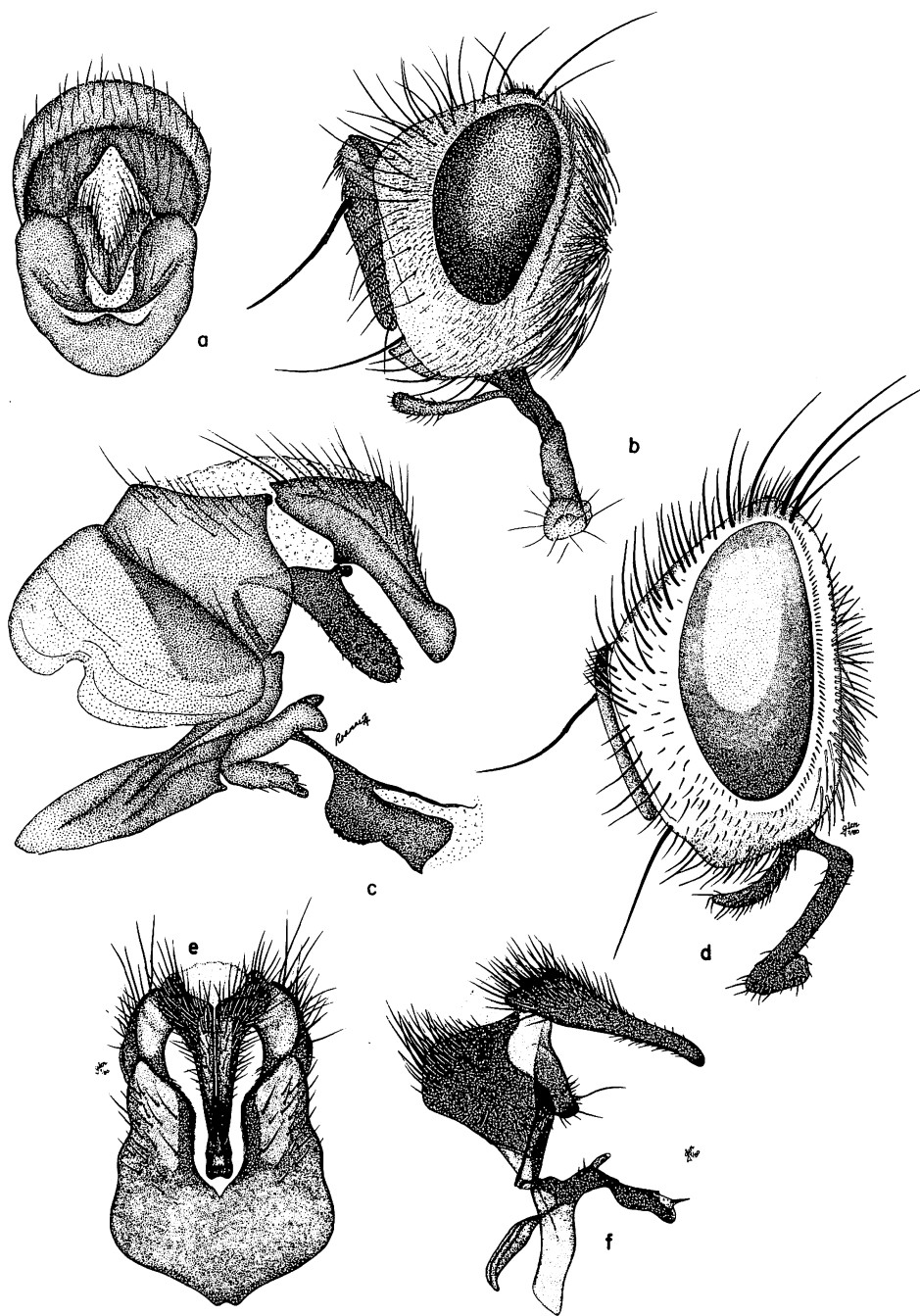


Figure 191—*Chaetogaedia monticola* (Bigot): a, male genitalia and fifth sternum, end view; b, head of male, lateral; c, male genitalia, lateral. *Pseudogonia rufifrons* (Wiedemann): d, head of male, lateral; e, male genitalia, end view; f, male genitalia, lateral.

Bionomics. An important parasite of cutworms, armyworms, other noctuids, pyralids and other lepidoptera larvae, including the endemic Kamehameha butterfly (*Vanessa tameamea* Eschscholtz) (Swezey 1926:356). The female glues the hard-shelled, microtype eggs on grass or other vegetation and they are eaten by the host. For biological data refer to Swezey (1907:49; 1909:25).

In Hawaii it is parasitized by *Brachymeria obscurata* (Walker) and is a "favorite prey of the larger Hawaiian Crabronidae" (Perkins 1913:clxxxv).

This has been confused with *Gonia longipulvilli* Tothill and with *Pseudogonia rufifrons* (Wiedemann) but is easily differentiated by having a row of prominent bristles along the facial ridges (fig. 191b); the ocellar bristles reclinate; abdomen rather densely gray to yellow-gray pollinose, obscuring most of the ground color; terga 1-4 mostly black, tinged with rufous on sides and tergum 5 all rufous in ground color; also by other characters mentioned under the discussions of *longipulvilli* and *rufifrons* and under the generic characters given above.

In addition to the above, differing from *Gonia longipulvilli* Tothill by having the parafacialia and parafrontalia densely gray pollinose, completely obscuring the ground color. The front gradually narrowed on the upper portion so that the eye orbits are slightly convergent dorsally and the face distinctly wider than the front. Also at the narrowest point the front is about one-fourth wider than one eye. Head shape and bristling, also antennae and mouthparts, as in figure 191b. Thorax densely gray pollinose with four rather distinct, subshining black vittae down mesonotum, rather Sarcophagid-like, entirely black except for rufous hind corners of mesonotum; also with scutellum mostly rufous, tinged with brown to black over basomedian portion. Bristling of thorax very similar to that of *Gonia*, except that the apical scutellars are cruciate and situated slightly below the secondary pair of apical scutellars, also the pteropleural bristles are not as large as the sternopleurals. Wings with only 2-4 setae at base of vein $R_4 + 5$ and the portion of vein $M_1 + 2$ from m crossvein to bend is slightly longer than in *longipulvilli*. Subcostal scale and epaulet dark brown to black. Legs with the tibiae rufous, tinged with brown. Abdomen as noted above. Male genitalia as in figures 191a,c.

Length: body, 7.0-12.0 mm.; average near 12 mm.

Genus **PSEUDOGONIA** Brauer and Bergenstamm

Pseudogonia Brauer and Bergenstamm, 1889, Denkschr. Akad. Wiss., Wien 56:100. Type-species, *Gonia cinerascens* Rondani, by monotypy, = *rufifrons* (Wiedemann).

Gaediogonia Townsend, 1927, Supplta ent. 16:71. Type-species, *jacobsoni* Townsend, by original designation, = *rufifrons* (Wiedemann).

Superficially resembling *Chaetogaedia* Brauer and Bergenstamm but differing by having strong reclinate ocellar bristles; no bristles on facial ridge; third antennal segment slightly pointed on upper apex (fig. 191d); basicostal scale mostly yellow, dark colored on front margin; upturned section of $M_1 + 2$ con-

cave beyond bend and distance from bend in vein to m crossvein longer than distance to wing margin; apical half of vein $M_3 + 4$ evanescent; the four sternopleural bristles situated in a straight line; apical scutellars parallel; fifth tergum with only distal bristles; male cerci long, slender, closely joined down mid line (fig. 191e); surstyli rather poorly developed by comparison (fig. 191f).

***Pseudogonia rufifrons* (Wiedemann) (figs. 191d-f)**

Tachina rufifrons Wiedemann, 1830, Aussereur. zweiflügel. Ins. 2:318.

Type-locality: China.

Latrellia lalandii Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci.

Fr. 2:106. Type-locality: Cape of Good Hope, South Africa.

For other synonymy refer to Crosskey, in Delfinado and Hardy (1977:685).

Oahu. First reported February 1977 (Hardy 1978). Found in student collections from numerous localities over Oahu and confused for several years with *Chaetogaedia monticola*. The earliest records are November and December 1973, taken at Waianae and Pearl City. It now is more abundant in the lowlands than *Chaetogaedia*.

Immigrant. Very widespread over much of the tropics and subtropics except for the New World. Oriental Region: Burma, South China, India, Java, Malaysia, Pakistan, Philippines, Sumatra, Thailand, and Taiwan; southern Palearctic Region and Australian Region: Australia, Hawaii, Moluccas, New Guinea, and Solomon Islands.

Hosts. Probably parasitizes a wide range of Noctuidae and other Lepidoptera. Mesnil (1956:536) recorded it from *Spodoptera litura* (Fabricius) in Taiwan and from *Plecoptera reflexa* Guénée, in India. No host information is available for Hawaii.

Like *Chaetogaedia monticola* in general facies: being rather sarcophagid-like, with mesonotum gray with four longitudinal black vittae and abdomen mostly black with gray markings; having the parafacialia and parafrontalia narrower than the eye and the latter with about three irregular rows of bristles and with no proclinate fronto-orbitals in male; arista not elbowed and second joint about 1/2 third; epaulet black and only a few setae at base of vein $R_4 + 5$.

It is readily differentiated from *monticola* by the characters given under the generic discussion. As seen with the naked eye, the only characters I see for separating these is that the apices of terga 3-5 are broadly shining black with basal 2/3 of each tergum consistently gray pollinose; also the fifth is black in ground color. In *monticola* the abdomen is rather densely gray to yellow-gray pollinose obscuring most of the ground color and without distinct apical bands of black; fifth tergum rufous in ground color.

The sexes are best differentiated by the lack of proclinate fronto-orbital bristles in male (fig. 191d). The margins of the fifth tergum completely enclose the genitalia and are often not visible *in situ*. The male genitalia are as in figures 191e,f.

Length: 7.0-13 mm.; average ca. 11.5 mm.

Tribe SIPHONINI

Members of this tribe are small species characterized by having the subapical scutellar bristles converging, enclosing the apical scutellars (setae-like) and often cruciate; front about as wide as face and with two strong proclinate fronto-orbital bristles in both sexes, no notable sexual dimorphism; existoma not protruded; basal excavation of abdomen extending about half the length of tergum 1 + 2; vein $R_4 + 5$ ends at wing tip and no dark fold or line extending from the bend of $M_1 + 2$ (the bend is lacking in the Hawaiian representative); third costal section (between apices of veins Sc and R_1) very short, shorter than m crossvein; arista short and thick with the second joint elongated (fig. 192b); only three hypopleural bristles present; and lobes of male cerci fused at apices (fig. 192c).

According to Sabrosky and Arnaud, *in* Stone et al. (1965:1059), "With few exceptions the members of the tribe Siphonini are small and parasitize the larvae of various Microlepidoptera such as *Laspeyresia*, *Rhyacionia*, *Tortrix* and *Tinea*."

Genus **ACTIA** Robineau-Desvoidy

Actia Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2):85.

Type-species, *pilipennis* Robineau-Desvoidy, by subsequent designation (Van Emden 1954:63; suspension of the Rules required), = *lamia* (Meigen). For synonymy refer to Sabrosky and Arnaud, *in* Stone et al. (1965:1061) and to Crosskey, *in* Delfinado and Hardy (1977:642).

Readily differentiated by their small size, in combination with lacking the apical portion, the upcurved section, of vein $M_1 + 2$ (fig. 192a). The members of the genus are also characterized by the shape of the head; face long and oblique, with lower portion of head rather strongly narrowed as seen in lateral view (fig. 192b); third antennal large, extending almost to oral margin, especially in males; eyes bare or essentially so, with only a few very inconspicuous, short, scattered hairs (on the species at hand, visible only in profile under high magnification and with strong back lighting). Palpi and mouthparts rather short, the former clavate (fig. 192b), the mentum subequal to lower margin of head and labella rather broad. Basal portion of vein $R_4 + 5$ setose to the r-m crossvein. Third costal section, between apices of veins Sc and R_1 short, much shorter than m crossvein; sternopleuron with a row of black setae extending vertically from in front of mid coxae to the medio-dorsal margin between the upper sternopleural bristles; only one stigmatic and one propleural bristle present; humeri with three bristles in a row; subapical scutellar bristles much closer together than to the base; bristles of thorax depressed, directed posteriorly and abdomen lacking discal bristles on terga.

Parasites of microlepidoptera.

According to Mesnil (1962:797 and Van Emden 1954:63), the middle tibia of *Actia* is supposed to have a single anterodorsal bristle at distal one-third. In

the species at hand the middle tibia has no anterodorsal bristles. This is apparently a specific character as is the absence of the upswing on $M_1 + 2$.

***Actia eucosmae* Bezzi (figs. 192a-d)**

Actia eucosmae Bezzi, 1926, Ann. Mag. Nat. Hist. (9)17:239.

Oahu, Hawaii. First recorded from a specimen collected in a malaise trap July 1971, Kilauea Forest, 5,200 ft., Hawaii (Hardy 1975:16). Since collected in light traps from several areas on Oahu.

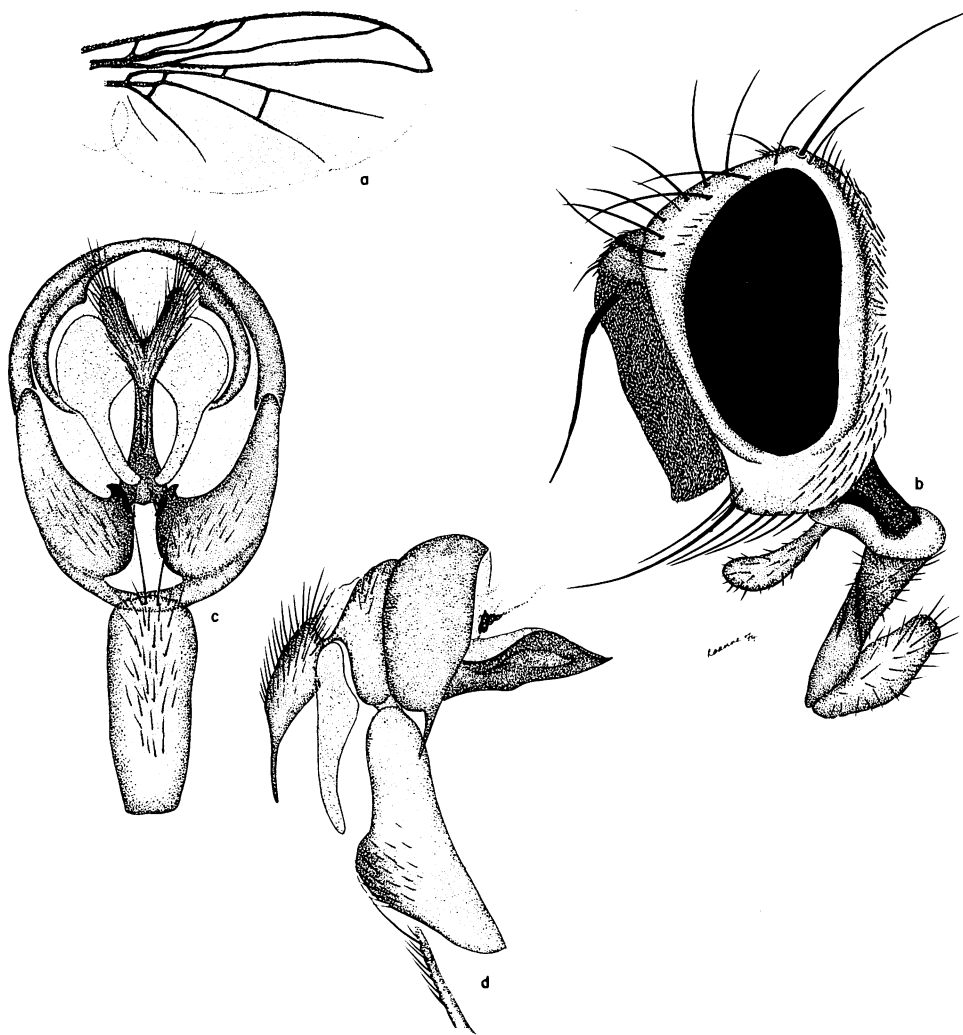


Figure 192—*Actia eucosmae* (Bezzi): a, wing; b, male head, lateral; c, male genitalia, fifth and fourth sternum, ventral; d, male genitalia, fifth and fourth sternum, lateral.

Immigrant. Australia and the Philippines.

Bionomics. The only known host, according to Crosskey, *in litt.*, is the tortricid moth, *Crocidosema plebeiana* Zell., in Australia. No host data available in Hawaii.

This species is differentiated from all other tachinids in Hawaii by its small size and the characters given above under the generic discussion. Head as in figure 192b; wing as in figure 192a; and male genitalia and fifth sternum as in figures 192c,d.

Length: body, 3.0–3.7 mm.

This species was synonymized with *fergusoni* Bezzi by H. G. Hardy (1959:213) but Dr. R. W. Crosskey has confirmed, *in litt.*, that this synonymy is not correct. *A. fergusoni* is characterized by having the third antennal segment split, with a cleft extending from near base to apex and bend of vein $M_1 + 2$ present. *A. eucosmae* is differentiated, according to Malloch (1930:130), by having the antennae normal; apical portion of vein $M_1 + 2$ lacking (fig. 192a); by absence of a strong submedian anterodorsal bristle on middle tibia; lower stigmatic bristle undeveloped; four pairs of postsutural dorsocentrals present; vein R_1 bare; and abdomen largely yellow basally, especially on sides.

Malloch (*loc. cit.*) recorded *eucosmae* from the Philippines, as well as Australia.

Tribe WINTHEMIINI

Characterized by having the raised upper portion of the hypopleuron ("beret") haired; five humeral bristles present; apical scutellars present, sometimes weak; ocellar bristles proclinate; eyes densely pilose; proboscis short; occiput with only white hair behind postocular row; female with upper bristle of frontal row reclinate, with bristles on hind margins of terga continuous to the sterna on the venter and ovipositor rather elongate, tube-like, and retractile. The female glues the short macrotype eggs on the body of the host.

Genus WINTHEMIA Robineau-Desvoidy

Winthemia Robineau-Desvoidy, 1830, Mém. prés. div. Sav. Acad. Sci. Fr. (2)2:173. Type-species, *Tachina variegata* Meigen (as Fabricius), by subsequent designation (Robineau-Desvoidy 1863:207).

For synonymy and a revision and a review of the Nearctic species refer to Guimaraes (1972:42). Also see Sabrosky (1973) and Crosskey, *in* Delfinado and Hardy (1977:662).

Characterized by having head wider than high, the parafacialia narrow and with fine hairs over the entire length; inner verticals moderately strong, outer verticals weak; arista elongate, two times longer than third antennal segment; no facial carina and epistoma short; middle tibia with only one strong anterodorsal bristle near middle; only two sternopleurals and with five

humeral; portion of vein $M_1 + 2$ from m crossvein to bend short, about half as long as the portion beyond bend and with no appendix at bend (fig. 193a); scutellum largely yellowish and sides of abdominal terga broadly red; fifth tergum truncate at apex.

For further descriptive details refer to Guimaraes (1972).

Winthemia diversoides Baranov? (figs. 193a-e)

Winthemia diversoides Baranov, 1932, Ent. NachrBl., Troppau 6:47. Type-locality: Sokutsu, Formosa.

In Mesnil (1949:80), this fits the subgenus *Crossotocnema* Bigot by having the scutellum predominantly yellow to rufous, the posterior intraalar bristles much longer than the prealars, and the posterior margin of the mesopleuron with long crinkly hair on hind margin. Crosskey, in Delfinado and Hardy (1977:662), synonymizes *Crossotocnema* with *Winthemia*. Also, Mesnil said the front is longer than the face but in the species at hand the two are approximately equal in length. In his key it runs near *mallochi* Baranov by having the crinkly hairs on hind margin of mesopleuron yellow and fourth abdominal tergum with only six marginal bristles. It apparently differs by the male having no marginal bristles on terga 2 and 3 and frontal tarsal claws and pulvilli longer than fifth tarsomere.

It is probable that the species introduced into Hawaii was not *diversoides*. Dr. Crosskey (*in litt.*) says much confusion exists in recognition of species of this genus, that there appears to be hair-color sexual dimorphism, making correlation of types of opposite sexes difficult. He said all old records of *diversoides* are suspect and should not be perpetuated.

Oahu. Purposely introduced from Keravat, New Britain, April 1963 (Chong 1965:5) for possible control of *Achaea janata* (L.) and *Anacamptodes fragilaria* (Grossbeck). It has not been recovered and the attempt was probably a failure.

The following notes pertain to the species that was introduced into Hawaii.

Face only slightly recessed, about equal in length to front. Compound eyes about two times higher than long. Frontal row of bristles extending to a level slightly beyond apex of second antennal segment. Proclinate fronto-orbitals absent in male, present in females. Antennae black except for inner portions which are rufous. Third segment approximately three times longer than wide and three times longer than second. Parafrontalia rather narrow, at median portion much longer than third antennal segment. Facial ridges setose only on lower portions just above vibrissae. Parafrontalia and parafrontalia rather densely long haired. Palpi yellow, gradually enlarged on apical portions, ventral margins strongly concave and dorsal margins convex. Mouthparts rather short, with the mentum less than two thirds as long as palpi, and with the labella well developed. Front femur with a complete row of rather strong posteroventral bristles and posterior surface densely covered with long, erect, black hairs. Scutellum rounded at apex, with the apical bristles strong,

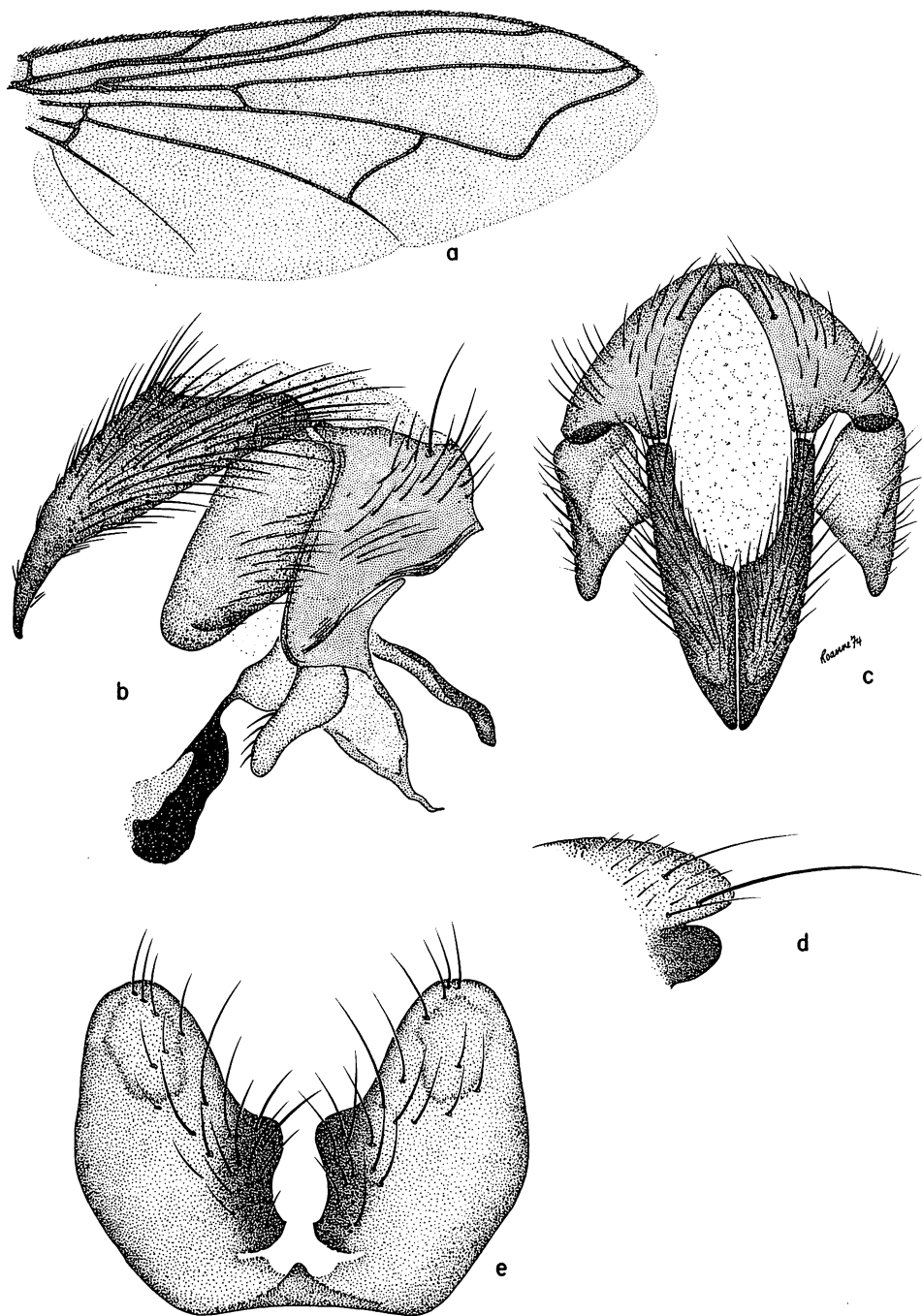


Figure 193—*Winthemia diversoides* Baranov?: a, wing; b, male genitalia, lateral; c, male genitalia, end view; d, scutellum and postscutellum, lateral; e, fifth sternum of male, ventral.

cruciate, almost equal in size to the secondary scutellars. Prosternum with several pale yellowish hairs on sides. Four pairs postsutural dorsocentrals. Mesonotum dull grayish, with four narrow subshining black vittae. Pile of pleura almost entirely yellow. One or two strong black setae at base of vein $M_3 + 4$. Wings hyaline. Third costal section rather long, four-fifths as long as second section and about two-thirds as long as fourth. Venation as in figure 193a. Abdomen lacking marginal bristles on first three terga, except for one or two laterals on the third. Fourth tergum with six strong marginals and no discals. Terga broadly rufous on sides, subshining black down median portion with the fifth tergum predominantly black, red around apical margin and on the lateral margins which are curved under onto the venter of the abdomen. The terga do not completely cover the sterna, all of the sterna are narrowly exposed the whole length of the abdomen. Bases of terga silvery gray pollinose. Fifth sternum as in figure 193e and male genitalia as in figures 193b,c.

Family GASTEROPHILIDAE Horse Bot Flies

Rather large, densely yellow and brown pilose, rather bee-like flies. Resembling *Hypoderma* (Oestridae) because of their vestigial, nonfunctional mouthparts and hairy bodies and because their larvae are obligatory parasites of certain mammals, but the calypters are comparatively small; the mesonotal suture broadly interrupted medianly; and vein $M_1 + 2$ is straight, not bent upward beyond m, and the m crossvein is very near the r-m (fig. 194b). They fit in the superfamily Muscoidea along with Muscidae and Anthomyiidae, while Oestridae fit in the superfamily Oestroidea with the Calliphoridae, Sarcophagidae, and Tachinidae.

These flies are serious pests of horses. The larvae are parasites of the alimentary tract and the second and third instars are attached by their large mouthhooks to the wall of the esophagus, stomach, and intestines.

Gasterophilidae 2nd and 3rd instar larvae are differentiated from Oestridae by the posterior peritremes having slits (fig. 194h), rather than a large number of small pores (fig. 196c).

The studies of Pollock (1973) point out that, based upon the male genitalia and segmentation of the abdomen, the Gasterophilidae show close relationship to Glossinidae and to Hippoboscidae.

Refer to Zumpt for taxonomy (1953) and biology and veterinary importance (1965:110-128).

Genus **GASTEROPHILUS** Leach

Gasterophilus Leach, 1817, in Brewster, D., ed. The Edinburgh Encyclopaedia.

Vol. 12:162. Type-species *Oestrus equi* Clark, by subsequent designation (Curtis 1826: pl. 146), = *intestinalis* (De Geer).

For synonymy refer to Chillcott, in Stone et al. (1965:915).

Readily recognized by their hairy-bodied, bee-like appearance, the vestigial mouthparts, and the wing venation (figs. 194a,b).

Head rather narrow, as seen in side view about two times higher than long and in front view about as high as wide. The ptilonal sutures are very close together down the midline of the face (fig. 194a). The antennae are small, situated in deep pits, but more porrect and exposed than in Oestridae. The membrane on the wing is crinkly. Segments 6 and 7 of the female abdomen are elongated and form a large ovipositing structure which fits beneath the abdomen in a resting position (fig. 194e).

The species of *Gasterophilus* apparently show considerable variation in body coloration and coloration of the vestiture.

***Gasterophilus intestinalis* (De Geer) (figs. 194a-h)**

The Common Horse Bot or Nit Fly

Oestrus intestinalis De Geer, 1776, Mém. serv. l'hist. Insectes 6:229.

Oestrus equi Clark, 1797, Trans. Linn. Soc. Lond. 3:326.

General throughout the islands, wherever horses occur.

Immigrant. Cosmopolitan.

First recorded in Hawaii by Terry (1906:43) as *G. equi* (Clark).

Bionomics. The incubation period for the eggs is five days but hatching may be delayed by cool weather. The warmth from the lips and tongue of the horse as they lick and bite at their skin activates hatching. The first instar larvae are provided with an armature which enables them to excavate galleries in the subepithelial layers of the mucous membrane of the tongue and they burrow slowly through the mucosa toward the posterior end of the tongue. The young larvae remain in the tongue for at least 24 days. After molting, the second instar larvae attach themselves for a few days to the pharynx and the sides of the epiglottis then pass to the stomach and remain for approximately five weeks before molting to the third instar. The mature larvae are generally found clustered near the boundary of the nonglandular and glandular epithelia. The third instar requires about three to four weeks to complete development, then they detach themselves, pass out of the intestine with the feces and pupate in the soil. The length of the pupal stage varies considerably depending upon moisture and temperature and is usually from three to five weeks. Copulation takes place shortly after emergence of the adults and egg laying begins thereafter. Heavy infestation of bots may severely affect the health of the animal due to the extensive ulceration which takes place on the stomach wall. A number of cases of creeping myiasis in the skin of man have been reported in Europe and the United States (refer to Zumpt 1965:126). One case of ophthalmomyiasis in man in the United States was reported by Anderson (1935). In man the larvae do not survive past the first instar and the occasional accidental myiasis is of rather short duration.

Readily differentiated from *nasalis* by the dark markings in the wings (fig. 194b); by hind femora of both sexes, each with a ventral subbasal carina; hind

trochanter of male with a spatulate process (fig. 194d) and of female with a tubercle; lower calypter not larger than upper. Seventh segment of female abdomen longer than sixth (fig. 194e). By comparison with *nasalis* the abdomen is short, less conspicuously pilose; scutellum with a pair of tufts of conspicuous black hairs and mesonotum often with a band of black hairs behind suture.

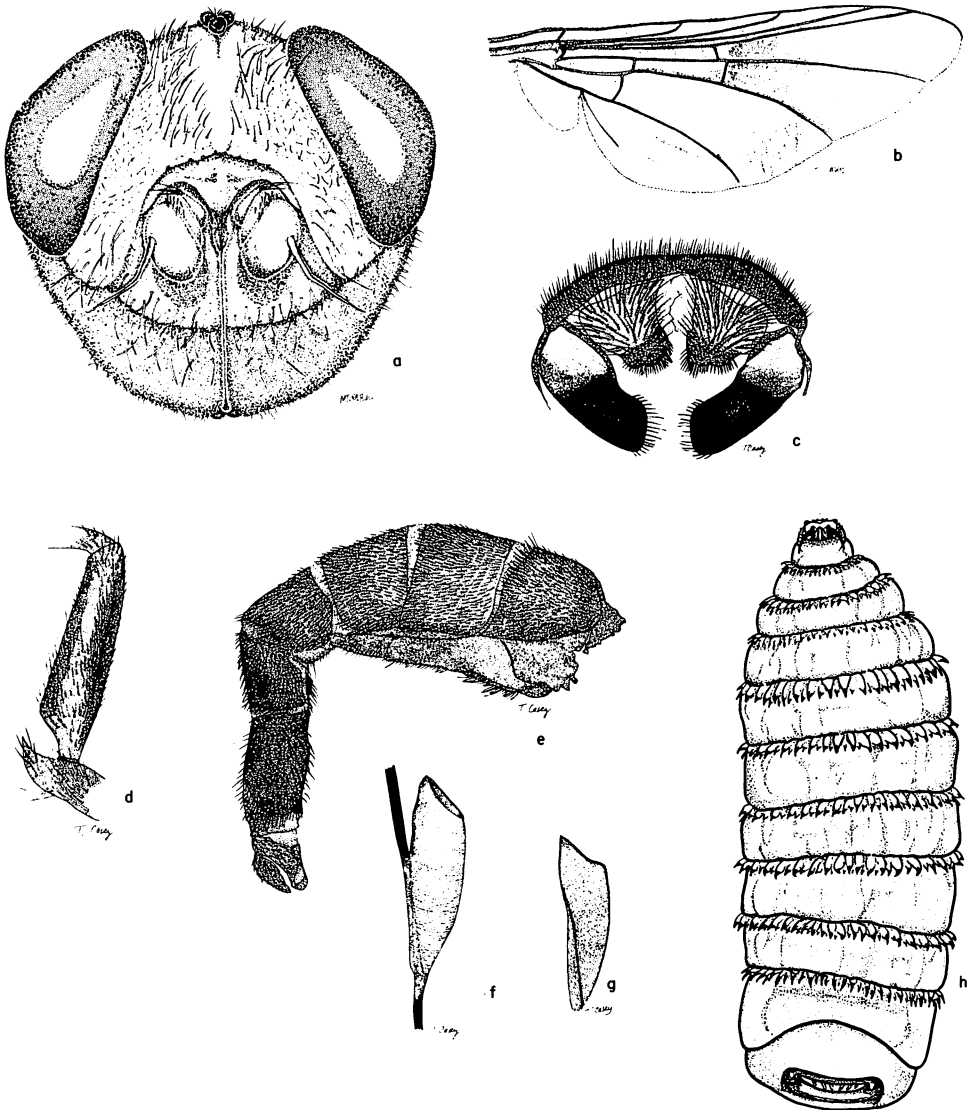


Figure 194—*Gasterophilus intestinalis* (DeGeer): a, female head, front view; b, wing; c, male genitalia, end view; d, hind trochanter and femur of male; e, female abdomen, lateral; f, egg glued onto hair; g, undeposited egg from inside female abdomen; h, 3rd instar larva, ventral.

The male genitalia are very different in development from *nasalis* (fig. 194c); the surstyli are broad and blunt.

Length: body, 11.0–15.0 mm.

The eggs are laid mainly on the hair of the fore legs, belly, flanks, and shoulders of the horse and are different in shape than those of *nasalis*. In lateral view they are rather wedge-shaped, obliquely truncate apically, and narrowed toward base with about basal half attached to the hair (fig. 194f). The third instar larva is differentiated from *nasalis* by having the spines on anterior margins of segment arranged in close-set, double rows (fig. 194h).

***Gasterophilus nasalis* (Linnaeus) (figs. 195a–c)**

The Throat Bot of Horses or Chin Fly

Oestrus nasalis Linnaeus, 1758, Systema naturae. Ed. 10, vol. 1:584.

Oestrus veterinus Clark, 1797, Trans. Linn. Soc. Lond. 3:328.

Gastrus subjacens Walker, 1849, List Dipt. colln. Br. Mus. 3:687.

General throughout the islands, wherever horses occur.

Immigrant. Cosmopolitan.

First recorded in Hawaii by Van Dine (1908:47). It is much less abundant than is *intestinalis*.

Bionomics. The female flies cause great annoyance to horses as they dart at

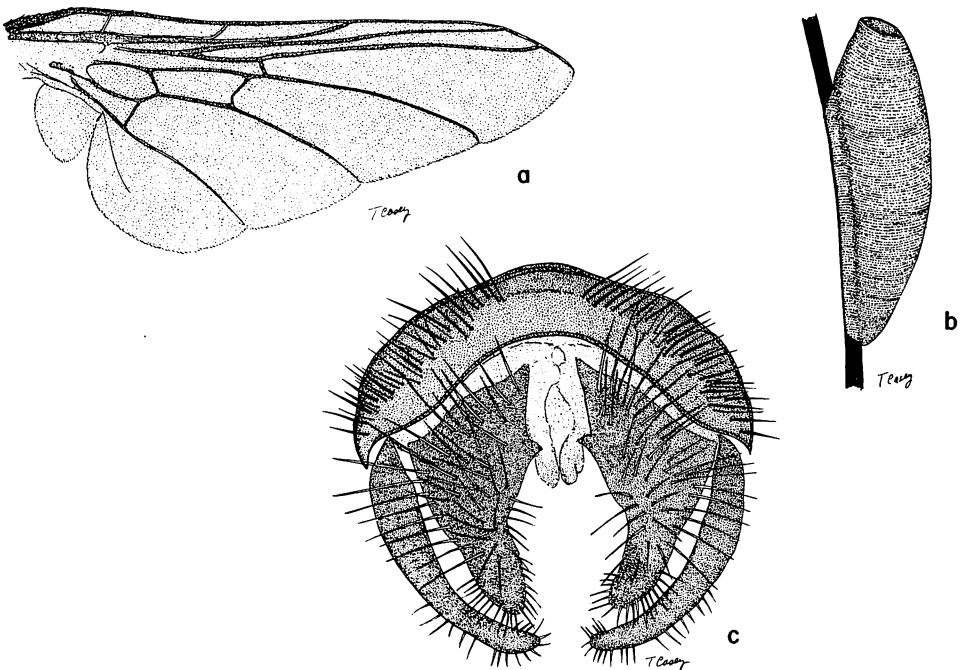


Figure 195—*Gasterophilus nasalis* (Linnaeus): a, wing; b, egg glued to hair; c, male genitalia, end view.

the throat of the animal in the act of ovipositing. The presence of the fly greatly excites the horse and as the females attack they throw their heads up as though struck under the chin. The larvae hatch in three to five days, apparently independent of moisture or heat applied by the host, and the first instars travel along the jaws and into the mouth between the lips. According to Zumpt (1965:118), "the larvae migrate to the lips and invade the spaces around and between the teeth below the gum line and behind the alveolar process of the gums. Necrosis of the tissue involved results in the formation of pus pockets, which have been found to contain as many as twelve larvae of the first and sometimes also of the second stage. The first instar larvae do not burrow in any other mouth tissue. The first stage lasts from 18 to 24 days and the second instar larvae stay a few more days in the mouth before they pass to the duodenum. They become attached to the wall near the pylorus and molt there to the third stage. The larvae reach maturity about eleven months after having hatched from the egg and are passed with the faeces." The pupal stage requires approximately three weeks. Apparently the principle damage done by this species is by causing necrosis of the tissues of the mouth and resulting in pus pockets which may extend into the tooth sockets. Zumpt (*op. cit.*, p. 119) indicates that "nothing is known about special pathological effects of the second and third instars in the duodenum and probably only unusually high infestations in horses may become alarming, and require treatment."

Zumpt says the first instar larvae are not able to penetrate the unbroken skin of man and therefore are probably not capable of causing creeping myiasis in humans.

Differentiated from *intestinalis* by having the wings entirely hyaline (fig. 195a); the lower calypter larger than the upper one; hind femora and trochanters normal; seventh segment of female abdomen shorter than sixth and the fifth segment curving under, forming the basal part of the ovipositing structure; abdomen densely and conspicuously long haired and pilosity of mesonotum and scutellum entirely yellow to reddish; the ground color of the thorax is mainly black and that of the abdomen dark reddish brown to blackish. The male genitalia are very different from those of *intestinalis* (fig. 195c), the surstyli are comparatively long and slender.

Length: body, 10.0–13.0 mm.

The eggs in lateral view are long, oval, tapered at both ends, not oblique apically, and are attached to the hair over most of their length (fig. 195b). They are found on the hairs of the head and neck of the animal.

The third instar larva is differentiated from *intestinalis* by having the spines on anterior margins of segments arranged in a single row.

Family OESTRIDAE

A family of bot flies related to Tachinidae because of the developed post-scutellum. Moderate to large, robust flies, often densely pilose, bee-like.

Characterized by the large head with lower portion rather gibbose, mouthparts greatly reduced, nonfunctional, and eyes broadly separated in both sexes; antennae short, decumbant, and partly sunken in the deep antennal pits (figs. 196a, 197e); lower calypters large; vein $R_4 + 5$ strongly bent upward beyond m crossvein, similar to Tachinidae and Sarcophagidae. In the species present in Hawaii, head and body lacking bristles and hind margin of hypopleuron with dense yellow-white hair.

The adults are very rapid fliers, rarely seen except near their host. They are difficult to capture and consequently are uncommon in collecting.

The larvae develop in the nasopharyngeal cavities or in skin boils (warbles) of mammals, and the second and third instars are characterized by having numerous small openings and lacking well-defined, slit-like spiracular openings on the posterior peritremes.

Subfamily HYPODERMATINAE

Robust, densely pilose, rather bee-like flies with cell R_5 open in wing margin and hind femora strongly thickened at bases. The third instar larvae have rudimentary mouthhooks.

Genus **HYPODERMA** Latreille

Hypoderma Latreille, 1818, Soc. de Naturalistes et d'Agric. Nouv. dict. d'hist. nat. Nouv. ed. (Ed. 2), 23:272. Type-species, *Oestrus bovis* Linnaeus, by monotypy.

Lithohypoderma Townsend, 1917, Insecutor Inscitiae Menstruus (1916) 4:129. Type-species, *Musca ascarides* Scudder, by original designation.

Characterized by lacking palpi; second antennal segment large, cup-like, covering over part of third (fig. 196a); antennae separated by median convexity or carina which extends to a level with lower margin of antennal pits; face densely pilose, facial sutures widely separated; and scutellum bare, polished black at apex, and with a rather distinct indentation in the middle.

The larvae have well-developed mouthhooks in the first instar, these become rudimentary after the first molt. They live as subcutaneous parasites of certain mammals. The two species present in Hawaii normally parasitize cattle but horses are occasionally infested and rare, accidental parasitism of man may occur.

Both *Hypoderma bovis* and *lineatum* have been recorded many times in the Hawaiian literature since they were reported by van Dine (1908). *H. bovis*, however, apparently did not become established until about 1959 (Hardy 1960b) and the earlier records were probably based upon misidentifications.

A case of human myiasis involving *Hypoderma* sp. occurred in Honolulu in 1962 (Joyce 1974, augmented by Hardy, telephone conversation with the doctor in charge of the case). One first instar larva came out of a hole in the skull of a five-year-old boy at Tripler Hospital and two larvae were removed from his leg. The body seemed to be suffering from a meningitis, had partial

paralysis accompanied by a high eosinophilia. It could not be determined whether or not these symptoms were caused by the myiasis nor could it be learned whether he acquired the infestation locally or brought it with him from the mainland United States.

***Hypoderma bovis* (Linnaeus) (figs. 196a-e)**

The Northern Cattle Grub

Oestrus bovis Linnaeus, 1785, *Systema nat.* Ed. 10, vol. 1:584.

Apparently on all of the main islands. Not definitely recorded until May 1959 (Hardy 1960b). It has been doubtfully recorded several times in Hawaiian literature, based no doubt on misidentifications (van Dine 1908:47).

Widespread across Europe, Canada, northern United States to California. Records from southern U. S. and the West Indies are from imported cattle.

Bionomics. The flies are active on calm, bright sunny days when the air temperature is above 18° C. The female commonly attacks on the wing at high

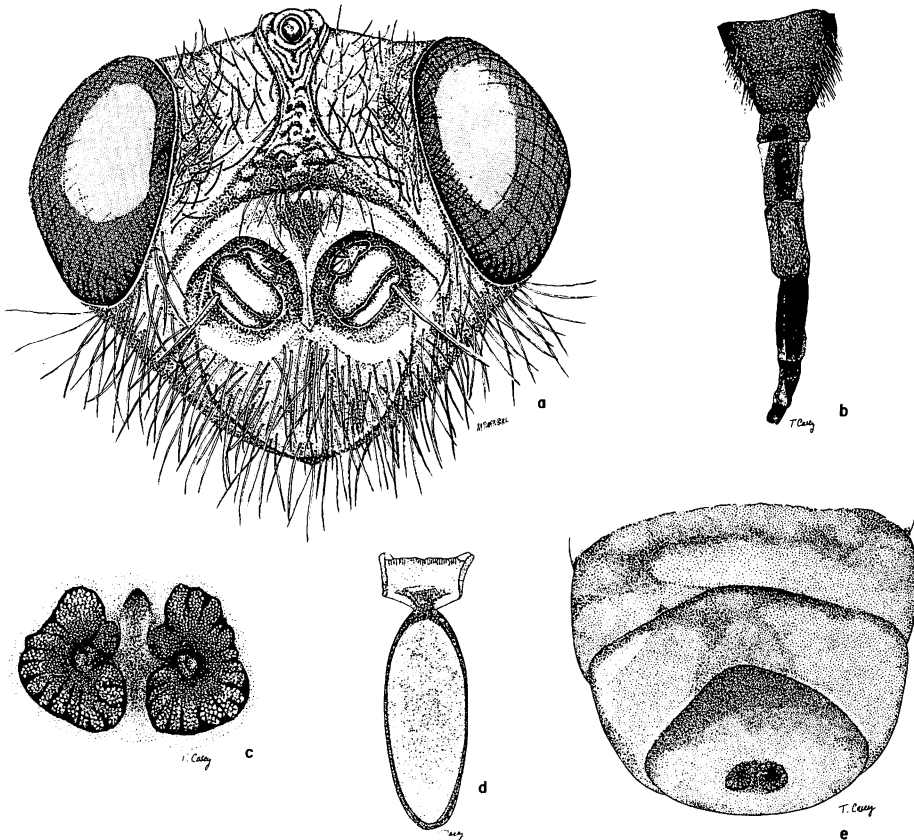


Figure 196—*Hypoderma bovis* (Linnaeus): a, head of female, frontal view; b, postabdomen of female, dorsal; c, posterior spiracles, third instar larva; d, egg; e, posterior three segments of third instar larva, ventral.

speed and lays as many as 800 eggs singly on the body hairs. The great activity of the flies while ovipositing causes much excitement of the animal and the presence of *bovis* is characterized by the so-called "gadding" or the erratic, wild running of the cattle when trying to seek water or shade in order to escape their enemy. The excitement and overexertion causes decrease in milk production in dairy herds, loss of weight in beef animals, and occasionally may cause some cows in calf to abort. The eggs hatch in four to seven days and the first instar larvae crawl down the hair and apparently may bore directly into the skin, or they may enter by way of the hair follicles, or possibly through minute openings in the skin, such as puncture wounds of *Haematobia irritans* (Linn.) or *Stomoxys calcitrans* (Linn.). The penetration of the skin apparently causes considerable irritation. According to Zumpt (1965:220), "the larvae then migrate below the skin, along the nerve trunks to the spinal canal, where they are found after at least four months between the periosteum and the dura matter. They remain in the spinal cord for only a short while, and continue their migration through the muscle and the fat tissues to the skin of the back. A small hole is formed and the larvae moult to the second stage, remaining stationary in the slowly enlarging swellings or 'warbles'. The posterior peritremes are located near the hole. The larvae are later surrounded by a bag of connective tissue, a defense reaction of the host. The moult to the third stage takes place in the warble, and the two larval stages spend about 11 weeks in the warble, according to other authors only 40-45 days depending on climatic factors. The dropping of the larvae extends over several months from early spring to the end of summer and the pupal period lasts 24-70 days." Bevan and Edwards (1951) said "no doubt much irritation and pain is suffered by the animals while the larvae burrow through the skin and later during their extensive wanderings through the different parts of the body. The tissues in the subcutaneous regions of the back are frequently inflamed and when such animals are slaughtered the flesh, which is at first straw-colored and jelly-like in appearance, turns into a dirty green, congealed mass, unfit for human consumption within a few hours. . . . Bacteria sometimes enter through the breathing holes made by the larvae in the skin and result in extensive abscess formation and in serious loss in body condition of the animal." One of the most apparent losses to the cattlemen is in the grubby hides, the perforations in the central part of the hide caused by the emergence of the larvae is the easiest of all grub damage to evaluate. The best part of the hide is made useless, especially in heavy infestations.

Human infestations with larvae of *bovis* have been recorded a number of times, but Zumpt (1965:221) indicated that many of these were probably confused with *lineatum* "the bionomics of the two species are very similar, and the syndrome they cause in man is possibly alike."

It is a mystery why this species was apparently unable to establish in Hawaii until the late 1950s and why it now occupies predominantly the lowland areas of the islands rather than the cool upland regions. This is a complete reversal from its climatic preference in other parts of the world. It would appear that a

subtropical strain has developed in the Hawaiian Islands which infests cattle down to sea level.

Differentiated from *lineatum* by having the mesonotum yellow to whitish pilose in front of the suture and black-haired behind, making a conspicuous black band between scutellum and suture. Abdomen with whitish or yellow pile on tergum 1 + 2, with yellow pile on 4 and 5, and with tergum 3 black pilose. Scutellum with a very indistinct indentation in middle at apex and basitarsi of all legs distinctly longer than combined lengths of next three tarsomeres. Head shaped as in figure 196a.

The eggs (fig. 196d) are laid singly at the bases of body hairs and measure about 1 mm. in length. The first instar larvae are characterized by having the mouthhooks divided at the apex into two blunt lobes and having no recurved tooth on outside edge. The second instar larvae are differentiated by having the posterior peritremes brown to black and with 29 to more than 40 (usually 32-37) closely grouped discs. The third instar larvae are characterized by having the posterior peritremes deeply excavated, with the inner borders rather closely approximated, leaving a rather long, narrow channel into the "button" (fig. 196c). The eleventh segment (following Zumpt 1965: = tenth segment of James 1948) is devoid of spines on both dorsum and the venter (fig. 196e).

***Hypoderma lineatum* (Villers) (figs. 197a-e)**

The Common Cattle Grub

Oestrus lineatum Villers, 1798, Caroli Linnaei entom. faun. suecicae descr. aucta 3:349.

Oestrus supplens Walker, 1849, List. Dipt. colln Br. Mus. 3:685.

Hypoderma bonassi Brauer, 1875, Verh. Zool.-bot. Ges. Wien 25:75.

Reported from all the main islands in imported cattle, apparently established only on the island of Hawaii (Sherman, in conversation). First reported, as *Hypoderma* sp., by Terry (1906:43).

Immigrant. Cosmopolitan.

Bionomics. The adult females lay numerous eggs in a row along the body hairs and the act of oviposition does not appear to excite the animals. After burrowing through the skin, the larvae make their way to the esophagus and remain for a period of time in the submucosa, probably migrating through the chest or abdominal cavities direct to the esophagus and apparently without invading the spinal canal. Zumpt (1965:223) says that "the larvae evidently appear in the submucosa four weeks after hatching from the eggs. They then have a length from 2 mm. in spring and summer up to 10-12 mm. in winter. They therefore remain there for relatively long periods. The further development is the same as in *H. bovis*. The first holes in the skin appear from mid-February to mid-March and the mature larvae drop in April and May." Zumpt (p. 224) says that "humans are occasionally attacked and the eggs are probably laid on the hairs of any area which the fly can reach. This has, how-

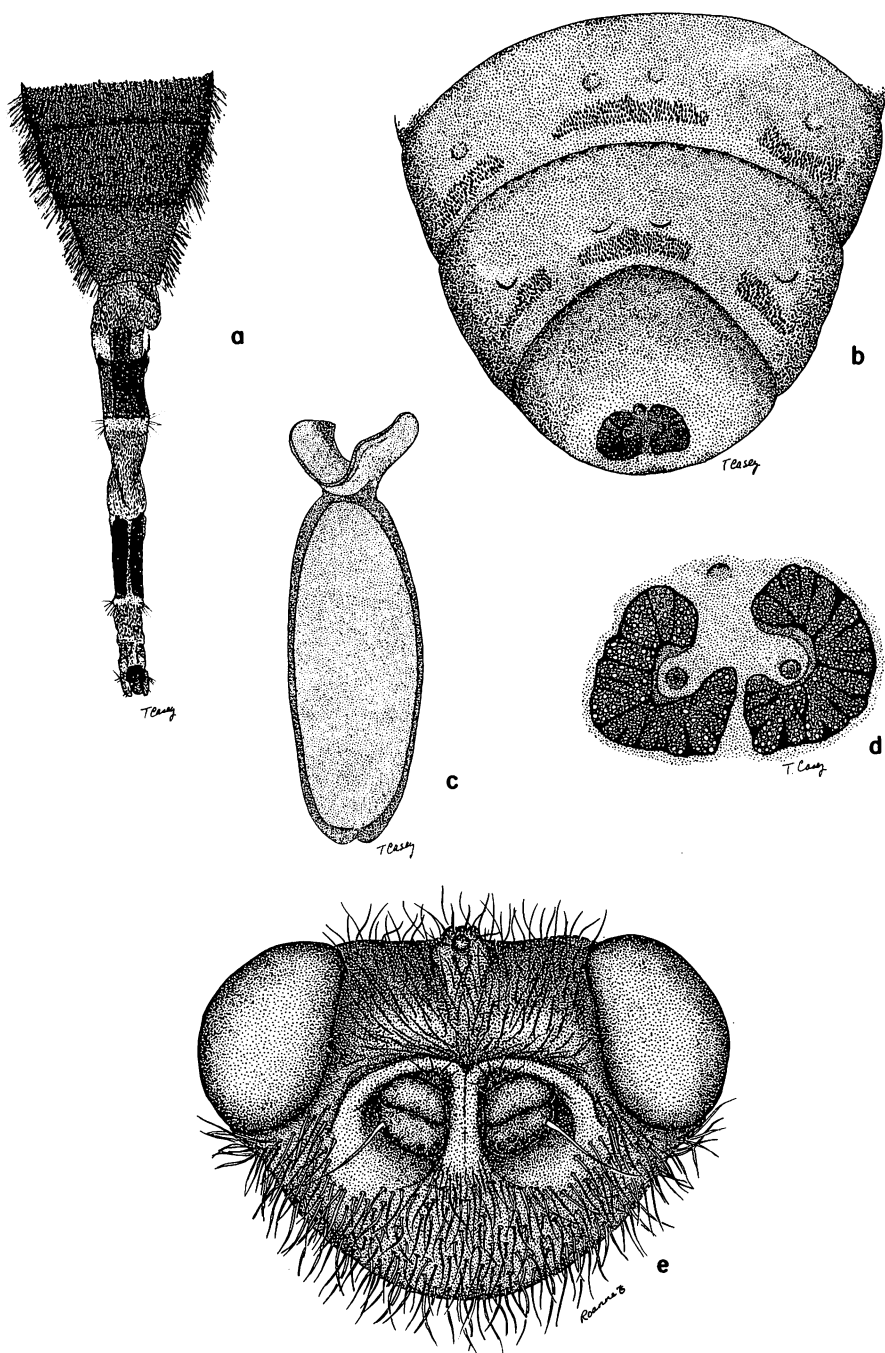


Figure 197—*Hypoderma lineatum* (Villers): a, female postabdomen, dorsal; b, posterior three segments of third instar larva, ventral; c, egg; d, posterior spiracles, third instar larva; e, head of female, frontal view.

ever, never actually been observed and it is also possible that this infestation results from handling cattle with freshly emerged larvae. They penetrate the skin and cause a subdermal creeping myiasis. Mostly involved are the back, the legs and the head, but larvae of the second and third stages have also been extracted from the genital region, the chest and the abdomen. First instar larvae which reach the orbit usually cause a malign ophthalmomyiasis with destruction of the eyeball." Refer to Zumpt (*loc. cit.*) for further details concerning human infestations.

This species is apparently restricted, in the Hawaiian Islands, to areas on the island of Hawaii from 2,000–6,000 ft. elevation. It has been noted for many years, previous to the establishment of *bovis* about 1959 (Hardy 1960b), that the cattle were not bothered by warble flies in the lowlands.

Erhorn (1916) indicated that ants were an important factor in controlling *H. lineatum*, from observations made on Molokai he concluded, "The large number of ants on the cattle ranges destroy the larvae as they emerge and fall to the ground to pupate."

Differentiated from *bovis* by having the mesonotum uniformly yellowish and brownish pilose, lacking a distinct crossband of black hairs. Abdomen with tergum 1 + 2 whitish, 3 and 4 are black-haired, and 5 is orange-haired. Scutellum with a distinct notch in the middle of apex. Basitarsis about equal to or slightly shorter than the combined lengths of the next three tarsomeres. The ovipositors of the two species differ as in 196b and 197a, the ovipositor of *bovis* is much more elongate than that of *lineatum*, the fully extended ovipositor is about 11.0 mm. in *bovis* and 8.0 in *lineatum*. Front of head as in figure 197e. In *bovis* the sclerites on the sides of the eighth tergum are elongate, sharply tapered, and pointed posteriorly. Also the ninth sternum is rather strongly bent upward. In *lineatum* the sclerites on the eighth tergum are broad, wider than long and the ninth tergum is gently upcurved.

The eggs are slightly stouter than in *bovis*, 0.8 mm.; they are laid in rows of 5–15 along the hairs. The eggs of *lineatum* have the basal attachment portion broadly U-shaped as in figure 197c, while those of *bovis* have the attachment portion broad with a rather slight concavity as in figure 196d. The first instar larvae have the mouthhooks sharp pointed at apices, not divided and each has a prominent, pointed, curved tooth on outside edge. The second instar larvae have the posterior peritremes orange or yellow-brown, with 12–25 (usually 18–25) separate or loosely connected discs. The third instar larvae are characterized by having the posterior peritremes rather shallowly excavated, the inner borders not approaching one another and leaving a broad channel to the "button" (fig. 197b). Eleventh segment with a band of spines along posterior margin on the venter.

Subfamily OESTRINAE

Differentiated by having cell R_5 closed and petiolate (fig. 198b); front broadly separated in both sexes (fig. 198a); face bare or with inconspicuous

setation; palpi present; parafrontalia with numerous pock-like pits, each bearing a seta; antennae not separated by a keel which is continuous onto the face. Third instar larvae with mouthhooks well developed, the anterior spiracles inconspicuous or absent. The larvae developed in the nasal cavities and head sinuses of sheep, goats, horses, antelopes, and other hoofed animals.

The sheep bot fly is the only species present in Hawaii.

Genus **OESTRUS** Linnaeus

Oestrus Linnaeus, 1758, *Systema nat.* Ed. 10, vol. 1:584. Type-species, *ovis* Linnaeus, by subsequent designation (Curtis 1826:pl. 106).

Cephalemyia Latreille, 1818, *Soc. de Naturalistes et d'Agric. Nouv. dict. d'hist. nat.* Nouv. ed. (ed. 2), 23:273. Type-species, *Oestrus ovis* Linnaeus, by monotypy.

Oestrus ovis Linnaeus (figs. 198a-h)

The Sheep Head-Maggot or Sheep Bot Fly

Oestrus ovis Linnaeus, 1758, *Systema nat.* Ed. 10, vol. 1:585.

Widespread over the islands wherever there are sheep. First recorded in Hawaii by Grimshaw (1901:20), collected Lihue, Kauai, 1896. It no doubt was introduced with the first sheep brought to Hawaii, the latter part of the eighteenth century.

Immigrant. Cosmopolitan.

Bionomics. The following account is from James and Harwood (1969:293): "The sheep bot fly normally deposits active young during early summer to autumn in the nostrils of sheep and goats and related wild hosts. One female fly may deposit as many as 500 larvae. The larvae at once begin to move up the nasal passages, working their way into the nasal and frontal sinuses often as far as the base of the horns in rams, and attach themselves to the mucus membranes. Here numbers of these whitish grubs may be found wedged closely together in various conditions of development. The grubs reach full growth with a length of 25-30 mm. by the following spring, a larval period of from 8 to 10 months. At the end of this time they work their way out of the nostrils (they are usually sneezed out), fall to the ground, and pupate in the next few hours. The pupal period lasts from three to six weeks and over, sometimes much more in areas where low temperatures prevail."

This species is a parasite of both sheep and goats but little information is available concerning the incidence of them in the latter host in Hawaii; only few records are available (Fullaway 1924).

Although man is not a normal host for this parasite, numerous cases of human parasitism have been reported in the literature (refer to James 1948:116 and Zumpt 1965:178). The larvae never develop beyond the first instar and most of the cases reported involve ocular myiasis, during this stage they can cause conjunctivitis and may cause permanent damage to the cornea. Three separate reports of cases of ophthalmomyiasis have been reported in Hawaii (Hardy 1956:13) and Herms (1925).

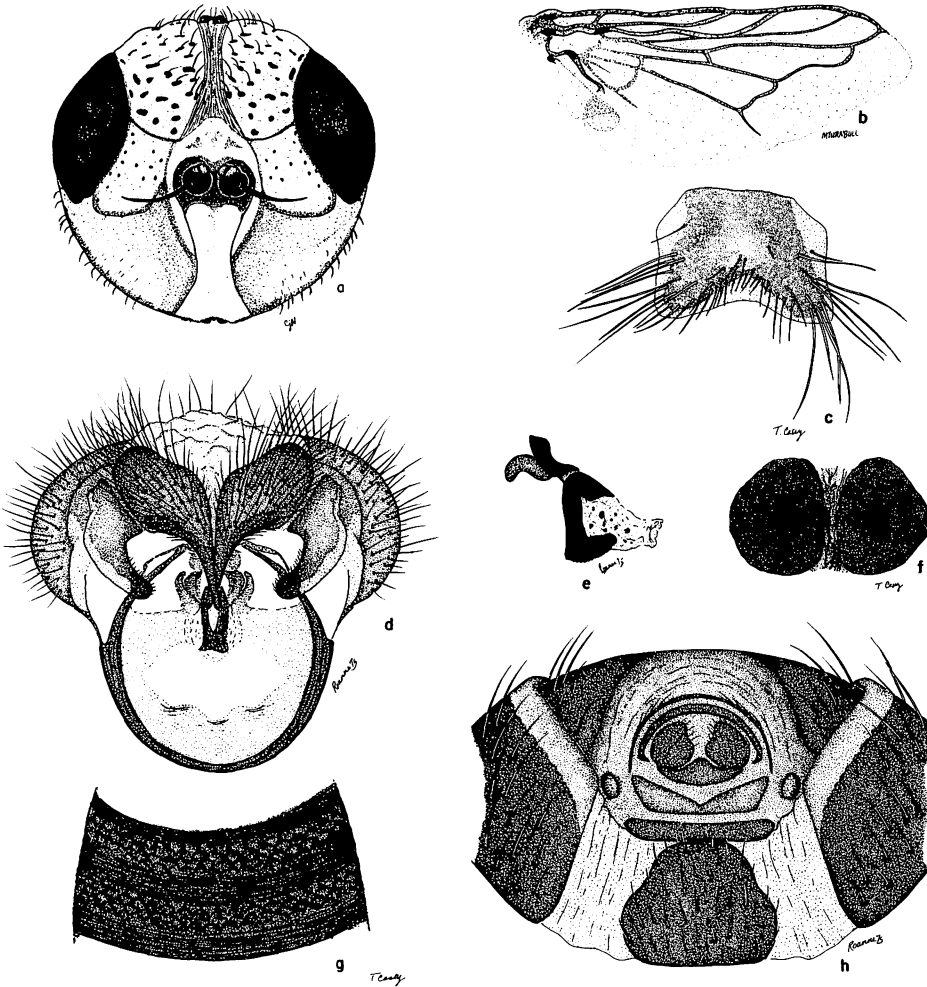


Figure 198—*Oestrus ovis* Linnaeus: a, head of female, front view; b, wing; c, fifth sternum of male, ventral; d, male genitalia, ventral; e, apical portion of aedeagus; f, posterior spiracles of third instar larva; g, two body segments of pupa, ventral; h, postabdomen of female, end view.

The flies are very rapid fliers and the females are able to larvaposit in the eyes and nostrils before the host is able to take evasive actions. The adults are dark yellowish to brownish gray, with the abdomen variegated gray to black or brownish yellow, and the legs yellow to rufous, tinged with brown. Head mostly yellow in ground color except for the black pock-like pits over the parafrontalia. The face is greatly expanded and the facial sutures are shaped as in figure 198a. Mesonotum and scutellum densely covered with small shining black tubercles each bearing a seta. Pleura rather densely white pilose. Abdomen with black setae over dorsum and longer white hairs on sides of terga and on sterna. Wings as in figure 198b, entirely hyaline and the membrane

crinkly. Costa devoid of setae along margin except at base and with a row of short, evenly spaced spinules extending along dorsal surface to apex and along ventral surface to end of subcostal vein. Each of the setae on dorsal portion of abdomen arises from a small, subshining black tubercle; these are not as large and pronounced as the ones on the mesonotum and scutellum. Fifth sternum of male with a broad V-shaped concavity on hind margin (fig. 198c). Cerci extended into long slender lobes and surstyli blunt at apices. Other details of genitalia as in figures 198d,e. Female genitalia as in figure 198h, lacking an extrudable ovipositor. The last spiracular openings have short setae around margins.

Length: body, 10–12 mm.

Mouthhooks of larvae well developed. Third instar devoid of spines dorsally and with prominent rows on all of the segments on the venter. The posterior peritremes have numerous small openings and no slits; they are completely closed, having no openings on inner margins leading to the “button” (fig. 198f). The pupa also has rows of ventral spines on the sterna (fig. 198g).

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